

**APPENDIX F – Biological Resources Assessment (BRA): Lookout Slough Tidal Habitat
Restoration and Flood Improvement Project.**

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Biological Resources Assessment

LOOKOUT SLOUGH TIDAL HABITAT RESTORATION AND FLOOD IMPROVEMENT PROJECT

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Date: January 2019
Revised December 2019



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LIST OF ACRONYMS AND ABBREVIATIONS

APN	Assessor Parcel Number
BRA	Biological Resources Assessment
Cal-IPC	California Invasive Plant Council
CBR	California black rail
CCR	California Code of Regulations
CDFG	California Department of Fish and Game
CDFW	California Department of Fish and Wildlife
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
CFGC	California Fish and Game Code
CNDDB	California Natural Diversity Database
CNPS	California Native Plant Society
Corps	U.S. Army Corps of Engineers
CWA	Clean Water Act
DPS	Distinct Population Segment
DWSC	Sacramento River Deep Water Shipping Channel
eDNA	Environmental DNA
EFH	Essential Fish Habitat
ESA	Federal Endangered Species Act
ESU	Evolutionarily Significant Unit
FAC	Facultative plant species
FACW	Facultative wetland plant species
FMP	Fisheries Management Plan
Inventory	California Native Plant Society Inventory of Rare and Endangered Plants
MBTA	Migratory Bird Treaty Act of 1918
MMPA	Marine Mammal Protection Act of 1972
MSL	Mean Sea Level
NFH	Livingston Stone National Fish Hatchery
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
OBL	Obligate wetland plant species
OHWM	Ordinary High Water Mark
qPCR	Quantitative Polymerase Chain Reaction
Rank	California Rare Plant Ranks
RWQCB	Regional Water Quality Control Board
SWHA TAC	Swainson's Hawk Technical Advisory Committee
TAC	Technical Advisory Committee
USDA	United States Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
WBWG	Western Bat Working Group
WRA	WRA, Inc.

EXECUTIVE SUMMARY

The purpose of this report is to provide an analysis to support the proposed Lookout Slough Tidal Habitat Restoration and Flood Improvement Project. Existing natural biological communities and potential special-status species were examined at the approximately 3,600-acre portion of land (Study Area), located in unincorporated Solano and Yolo Counties, California.

On multiple dates throughout 2017 and 2018, WRA, Inc. (WRA) conducted a biological resources assessment throughout the Study Area. WRA observed six biological communities, 189 plant species, and 88 wildlife species during the biological resources assessment. In total, three of the six biological communities, covering approximately 1,492 acres, were determined to be sensitive. Portions of these biological communities have been delineated as features subject to the jurisdiction of the Corps and RWQCB, and therefore these aquatic features are considered sensitive under CEQA. Jurisdictional aquatic features are discussed in a separate report. A total of 12 special-status plant species and 23 special-status wildlife species were determined to have a moderate or high potential of occurrence or are considered present within the Study Area.

1.0 INTRODUCTION

On multiple site visits in 2017 and 2018, WRA, Inc. (WRA) conducted assessments of biological resources at the 3,600-acre portion of land (Study Area), located primarily within unincorporated Solano County, with an approximately 24-acre portion in unincorporated Yolo County, California (Figure 1, Appendix A). The Study Area is located in the Liberty Island U.S. Geological Survey (USGS) 7.5-minute quadrangle (USGS 2018) and contains three distinct areas and bordering levees and sloughs: (1) Bowsbey Ranch (Assessor Parcel Numbers [APNs]: 0143-240-030, 0143-240-040, 0042-140-200, and 0042-140-210), located in the northern and eastern portions of the Study Area; (2) Liberty Farms (APNs: 0042-140-070, 0042-140-230, 0042-140-120, 0042-140-140, 0042-140-240, 0042-140-250, 0042-160-170, 0042-160-180, and 0042-140-110), located in the southern portion of the Study Area; and (3) Vogel (APNs 0042-140-100 and 0042-140-160) located in the southern portion of the Study Area (Figure 2).

For the purpose of this assessment, the Study Area was expanded beyond the APN property boundaries to include jurisdictional waters. The Study Area contains three non-tidal slough channels: Duck Slough, Lookout Slough, and Sycamore Slough. The Study Area is bounded by undeveloped land and tidal sloughs, including Cache Slough and Hass Slough to the west and south, which comprise a portion of the Cache Slough Complex, and Shag Slough to the east, which falls within the Yolo Bypass. Both Bowsbey Ranch and Liberty Farms are currently located behind an U.S. Army Corps of Engineers (Corps) levee associated with the Yolo Bypass West levee system, whereas the Vogel property is located outside of the Corps levee.

The biological resources assessment (BRA) was conducted to identify, describe, and map the current baseline conditions within the Study Area. This assessment was based on-site conditions observed on the dates of the site visits, a review of public databases and related literature available at the time of the assessment, and past reports completed in areas proximal to the Study Area. The BRA includes protocol-level special-status plant surveys; however, protocol-level surveys for listed wildlife species were not completed. Additional protocol-level surveys may be required for Project approval by local, state, or federal agencies. This report describes the results of the site visits, which assessed the Study Area for: (1) the potential to support special-status species, and (2) the presence of other sensitive biological resources protected by local, state, and federal laws and regulations. A formal delineation of aquatic resources within the Study Area was completed concurrent with the BRA site visits and additional information and delineation results are provided in the Aquatic Resources Delineation Report (WRA 2018).

2.0 REGULATORY BACKGROUND

The following sections explain the regulatory context of the BRA, including applicable laws and regulations that were applied to the field investigations.

2.1 Sensitive Biological Communities

Sensitive biological communities include habitats that fulfill special functions or have special values, such as wetlands, streams, or riparian habitat. These habitats are protected under federal regulations, such as the Clean Water Act (CWA); state regulations, such as the Porter-Cologne Act, the California Department of Fish and Wildlife (CDFW) Streambed Alteration Program, and the California Environmental Quality Act (CEQA); or local ordinances or policies, such as city or county tree ordinances, Special Habitat Management Areas, and General Plan Elements.

Waters of the United States

The Corps regulates “Waters of the United States” under Section 404 of the CWA. Waters of the U.S. are defined in the Code of Federal Regulations (CFR) as waters susceptible to use in commerce, including interstate waters and wetlands, all other waters (intrastate waterbodies, including wetlands), and their tributaries (33 CFR 328.3). Potential wetland areas, according to the three criteria used to delineate wetlands as defined in the *Corps of Engineers Wetlands Delineation Manual* (Environmental Laboratory 1987), are identified by the presence of: (1) hydrophytic vegetation, (2) hydric soils, and (3) wetland hydrology. Areas that are inundated at a sufficient depth and for a sufficient duration to exclude growth of hydrophytic vegetation are subject to Section 404 jurisdiction as “other waters” and are often characterized by an ordinary high water mark (OHWM). Other waters, for example, generally include lakes, rivers, and streams. The placement of fill material into Waters of the U.S. generally requires an individual or nationwide permit from the Corps under Section 404 of the CWA.

Waters of the State

The term “Waters of the State” is defined by the Porter-Cologne Act as “any surface water or groundwater, including saline waters, within the boundaries of the state.” The Regional Water Quality Control Board (RWQCB) protects all waters in its regulatory scope and has special responsibility for wetlands, riparian areas, and headwaters. These waterbodies have high resource value, are vulnerable to filling, and are not systematically protected by other programs. RWQCB jurisdiction includes “isolated” wetlands and waters that may not be regulated by the Corps under Section 404. Waters of the State are regulated by the RWQCB under the State Water Quality Certification Program, which regulates discharges of fill and dredged material under Section 401 of the CWA and the Porter-Cologne Water Quality Control Act. Projects that require a Corps permit, or fall under other federal jurisdiction, and have the potential to impact Waters of the State, are required to comply with the terms of the Water Quality Certification determination. If a proposed project does not require a federal permit, but does involve dredge or fill activities that may result in a discharge to Waters of the State, the RWQCB has the option to regulate dredge and fill activities under its state authority in the form of Waste Discharge Requirements.

Streams, Lakes, and Riparian Habitat

Streams and lakes, as habitat for fish and wildlife species, are subject to jurisdiction by the CDFW under Sections 1600-1616 of the California Fish and Game Code (CFGF). Alterations to or work within or adjacent to streambeds or lakes generally require a Section 1602 Lake and Streambed Alteration Agreement. The term “stream”, which includes creeks and rivers, is defined in the California Code of Regulations (CCR) as “a body of water that flows at least periodically or intermittently through a bed or channel having banks and supports fish or other aquatic life [including] watercourses having a surface or subsurface flow that supports or has supported riparian vegetation” (14 CCR 1.72). In addition, the term “stream” can include ephemeral streams, dry washes, watercourses with subsurface flows, canals, aqueducts, irrigation ditches, and other means of water conveyance if they support aquatic life, riparian vegetation, or stream-dependent terrestrial wildlife (California Department of Fish and Game [CDFG] 1994). “Riparian” is defined as “on, or pertaining to, the banks of a stream.” Riparian vegetation is defined as “vegetation which occurs in and/or adjacent to a stream and is dependent on, and occurs because of, the stream itself” (CDFG 1994). Removal of riparian vegetation also requires a Section 1602 Lake and Streambed Alteration Agreement from the CDFW.

Other Sensitive Biological Communities

Other sensitive biological communities not discussed above include habitats that fulfill special functions or have special values. Natural communities considered sensitive are those identified in local or regional plans, policies, regulations, or by the CDFW. The CDFW ranks sensitive communities as "threatened" or "very threatened" and keeps records of their occurrences in its California Natural Diversity Database (CNDDDB; CDFW 2018a). Sensitive plant communities are also identified by the CDFW (California Native Plant Society [CNPS] 2018a). CNDDDB vegetation alliances are ranked 1 through 5 based on NatureServe's (2010) methodology, with those alliances ranked globally (G) or statewide (S) as 1 through 3 considered sensitive. Impacts to sensitive natural communities identified in local or regional plans, policies, or regulations, or those identified by the CDFW or U.S. Fish and Wildlife Service (USFWS), must be considered and evaluated under CEQA (CCR Title 14, Div. 6, Chap. 3, Appendix G). Specific habitats may also be identified as sensitive in city or county general plans or ordinances.

Solano County Multispecies Habitat Conservation Plan

Solano County is a member of a habitat conservation plan that allows local agencies to be issued incidental take permits via State and Federal agencies for the 37 species covered. Additional species are covered for the purpose of allowing a single review of all potential impacts to sensitive species. Projects seeking coverage under the Solano County Habitat Conservation Plan are required to present mandatory baseline studies, avoidance and minimization measures, and mitigation measure requirements prior to obtaining any incidental take coverage.

2.2 Sensitive Special-Status Species

Special-status species include those plants and wildlife species that have been formally listed, are proposed as endangered or threatened, or are candidates for such listings under the federal Endangered Species Act (ESA) or California Endangered Species Act (CESA). These acts afford protection to both listed species and those that are formal candidates for listing. The federal Bald and Golden Eagle Protection Act also provides broad protections to both eagle species that in some regards are similar to those provided by ESA. Additionally, CDFW Species of Special Concern, CDFW California Fully Protected species, USFWS Birds of Conservation Concern, and CDFW Special-status Invertebrates are all considered special-status species. Although these aforementioned species generally have no special legal status, they are given special consideration under CEQA. Bat species are also evaluated for conservation status by the Western Bat Working Group (WBWG), a non-governmental entity; bats named as a "High Priority" or "Medium Priority" species for conservation by the WBWG are typically considered special-status and also considered under CEQA. In addition to regulations for special-status species, most native birds in the United States (including non-status species) are protected by the federal Migratory Bird Treaty Act of 1918 (MBTA) and the CFGC: Sections 3503, 3503.5, and 3513. Under these laws, deliberately destroying active bird nests, eggs, and/or young is illegal. Although not all marine mammals are considered special-status species, all marine mammals are protected under the Marine Mammal Protection Act of 1972 as amended (MMPA), and unauthorized take including harassment is prohibited.

Plant species on the CNPS Inventory of Rare and Endangered Plants (Inventory) with California Rare Plant Ranks (Rank) of 1 and 2 are also considered special-status plant species and must be considered under CEQA. Rank 3 and Rank 4 species are afforded little or no protection under CEQA, but are included in this analysis for completeness. A description of CNPS Ranks is provided below in Table 1.

Table 1. Description of CNPS Ranks and Threat Codes

California Rare Plant Ranks (formerly known as CNPS Lists)	
Rank 1A	Presumed extirpated in California and either rare or extinct elsewhere
Rank 1B	Rare, threatened, or endangered in California and elsewhere
Rank 2A	Presumed extirpated in California, but more common elsewhere
Rank 2B	Rare, threatened, or endangered in California, but more common elsewhere
Rank 3	Plants about which more information is needed - A review list
Rank 4	Plants of limited distribution - A watch list
Threat Ranks	
0.1	Seriously threatened in California
0.2	Moderately threatened in California
0.3	Not very threatened in California

Critical Habitat

Critical habitat is a term defined in the ESA as a specific and designated geographic area that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection. The ESA requires federal agencies to consult with the USFWS to conserve listed species on their lands and to ensure that any activities or projects they fund, authorize, or carry out will not jeopardize the survival of a threatened or endangered species. In consultation for those species with critical habitat, federal agencies must also ensure that their activities or projects do not adversely modify critical habitat to the point that it will no longer aid in the species' recovery. In many cases, this level of protection is similar to that already provided to species by the ESA jeopardy standard. However, areas that are currently unoccupied by the species but which are needed for the species' recovery are protected by the prohibition against adverse modification of critical habitat.

Essential Fish Habitat

Essential Fish Habitat (EFH) is regulated through the National Marine Fisheries Service (NMFS), a division of the National Oceanic and Atmospheric Administration (NOAA). Protection of EFH is mandated through changes implemented in 1996 to the Magnuson-Stevens Fishery Conservation and Management Act to protect the loss of habitat necessary to maintain sustainable fisheries in the United States. The Magnuson-Stevens Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" [16 USC 1802(10)]. NMFS further defines essential fish habitat as areas that "contain habitat essential to the long-term survival and health of our nation's fisheries" (NMFS 2007). EFH can include the water column, certain bottom types such as sandy or rocky bottoms, vegetation such as eelgrass or kelp, or structurally complex coral or oyster reefs. Under regulatory guidelines issued by NMFS, any federal agency that authorizes, funds, or undertakes action that may affect EFH is required to consult with NMFS (50 CFR 600.920).

3.0 METHODS

Multiple site visits to the Study Area were conducted to perform baseline and focused biological surveys. During the site visits, shown below in Table 2, the Study Area was traversed on foot to determine: (1) plant communities present within the Study Area; (2) if existing conditions provided suitable habitat for any special-status plant or wildlife species; and (3) if sensitive habitats are present. All plant and wildlife species encountered were recorded and are summarized in Appendix B. Plant nomenclature follows Baldwin et al. (2012) and subsequent revisions by the Jepson Flora Project (2018), except where noted. Relevant synonyms are provided in brackets due to recent changes in classification for many of the taxa treated by Baldwin et al. and the Jepson Flora Project. For cases in which regulatory agencies, the CNPS, or other entities base rarity on older taxonomic classifications, precedence was given to the classifications used by those entities. In some cases, it was necessary to expand our assessment beyond the Study Area shown on Figure 1 in Appendix A to include adjacent sloughs, which are hydrologically important to the Study Area and may supply water for agriculture, or inundate the Study Area during seasonal flooding.

Table 2. Biological Surveys in the Study Area

Survey Date	Survey Effort
January 6 and 13, 2017	Bowlsbey Ranch and Vogel property general biological reconnaissance survey
July 28, 2017	Giant Garter Snake eDNA survey
September 19, 2017	Liberty Farms general biological reconnaissance surveys
September 20-21 and 29, 2017	Protocol level special-status plant surveys
October 2, 2017	Protocol level special-status plant surveys
March 8 and 9, 2018	General Fish Assemblage
April 4 and 5, 2018	Delineation of aquatic resources
March 23 through April 18, 2018	Swainson's Hawk and Nesting Raptors surveys
April 18, 2018	California Black Rail assessment
May 9, 2018	Delineation of aquatic resources
August 27 and September 7, 2018	Valley Elderberry Longhorn Beetle survey
July 20, 2018	Delineation of aquatic resources

3.1 Biological Communities

Prior to the site visits, the Soil Survey of Solano County, California (USDA 1977) was examined to determine if any unique soil types that could support sensitive plant communities were present in the Study Area. Biological communities present in the Study Area were classified based on existing plant community descriptions described in the *Preliminary Descriptions of the Terrestrial Natural Communities of California* (Holland 1986). However, in some cases it is necessary to identify variants of community types or to describe unvegetated areas that are not described in the literature. Biological communities were classified as sensitive or non-sensitive as defined by CEQA and other applicable laws and regulations.

3.1.1 Non-sensitive Biological Communities

Non-sensitive biological communities are those communities that are not afforded special protection under CEQA, and other state, federal, and local laws, regulations and ordinances. These communities may, however, provide suitable habitat for some special-status plant or wildlife species, and are identified or described in Section 4.1.1 below.

3.1.2 Sensitive Biological Communities

Sensitive biological communities are defined as those communities that are given special protection under CEQA and other applicable federal, state, and local laws, regulations and ordinances. Applicable laws and ordinances are discussed above in Section 2.0. Special methods used to identify sensitive biological communities are discussed below.

Jurisdictional Wetlands and Non-Wetland Waters

The Study Area was surveyed to determine if any wetlands and non-wetland waters potentially subject to jurisdiction by the Corps, RWQCB, or CDFW were present. A wetland delineation was performed concurrently during the BRA surveys, on April 4-5, May 9, and July 20, 2018, and was based primarily on the presence of wetland plant indicators; however, it also included observed indicators of wetland hydrology and wetland soils. Any potential wetland areas were identified as areas dominated by plant species with a wetland indicator status¹ of obligate (OBL), facultative wetland (FACW), or facultative (FAC), as provided on the Corps National Wetlands Plant List (Lichvar et al. 2016). Evidence of wetland hydrology can include direct evidence (primary indicators), such as visible inundation or saturation, algal mats, and oxidized root channels, or indirect (secondary) indicators, such as a water table within two feet of the soil surface during the dry season. Some indicators of wetland soils include dark colored soils, soils with a sulfidic odor, and soils that contain redoximorphic features as defined by the Corps Manual (Environmental Laboratory 1987) and *Field Indicators of Hydric Soils in the United States* (NRCS 2010).

The wetland delineation was based primarily on the presence of unvegetated, ponded areas or flowing water, or evidence indicating their presence, such as a high water mark or a defined drainage course. The wetland delineation was used to inform the BRA regarding the sensitivity of community types, as jurisdictional communities are considered sensitive. A more detailed

¹ OBL = Obligate, almost always found in wetlands; FACW = Facultative wetland, usually found in wetlands; FAC = Facultative, equal occurrence in wetland or non-wetlands.

description of delineation methods and results can be found in the wetland delineation report concurrently conducted during this BRA (WRA 2018).

Other Sensitive Biological Communities

The Study Area was evaluated for the presence of other sensitive biological communities, including riparian areas and sensitive plant communities recognized by the CDFW. Prior to the site visit, aerial photographs, local soil maps, and *A Manual of California Vegetation, Online Edition* (CNPS 2018a) were reviewed to assess the potential for sensitive biological communities to occur in the Study Area. All alliances within the Study Area with a ranking of 1 through 3 were considered sensitive biological communities and were mapped. These communities are described in Section 4.1.2 below.

3.2 Special-Status Species

3.2.1 Literature Review

The potential occurrence of special-status species in the Study Area was evaluated by first determining which special-status species occur in the vicinity of the Study Area through a literature and database search. Database searches for known occurrences of special-status species focused on the Liberty Island 7.5-minute USGS quadrangle and the eight surrounding USGS quadrangles. The following sources were reviewed to determine which special-status plant and wildlife species have been documented to occur in the vicinity of the Study Area:

- CNDDDB records (CDFW 2018a)
- USFWS Information for Planning and Conservation Species Lists (USFWS 2018b)
- USFWS Critical Habitat Mapper (USFWS 2018c)
- CNPS Inventory records (CNPS 2018b)
- CDFG publication *California's Wildlife, Volumes I-III* (Zeiner et al. 1990)
- CDFG publication *California Bird Species of Special Concern* (Shuford and Gardali 2008)
- CDFW and University of California Press publication *California Amphibian and Reptile Species of Special Concern* (Thomson et al. 2016)
- *A Field Guide to Amphibians and Reptiles of California* (Stebbins and McGinnis 2012)
- *Fairy Shrimps of California's Puddles, Pools and Playas* (Eriksen and Belk 1999)
- University of California at Davis Information Center for the Environment Distribution Maps for Fishes in California (2018)
- National Marine Fisheries Service Official Species List Generator (2018a)
- National Marine Fisheries Service Distribution Maps for California Salmonid Species (2018b)
- National Marine Fisheries Service, Essential Fish Habitat Mapper (2018c)
- Breeding Birds of Solano County (Rippey 2014)
- The Solano County Habitat Conservation Plan (Solano 2012)
- Western Bat Working Group Species Accounts (WBWG 2018)

3.2.2 Site Assessment

Several site visits to the Study Area were conducted to search for suitable habitats for special-status species. Habitat conditions observed in the Study Area were used to evaluate the potential for presence of special-status species based on these searches and the professional expertise of

the investigating biologists. The potential for each special-status species to occur in the Study Area was then evaluated according to the following criteria:

- No Potential. Habitat on and adjacent to the site is clearly unsuitable for the species requirements (foraging, breeding, cover, substrate, elevation, hydrology, plant community, site history, disturbance regime).
- Unlikely. Few of the habitat components meeting the species requirements are present, and/or the majority of habitat on and adjacent to the site is unsuitable or of very poor quality. The species is not likely to be found on the site.
- Moderate Potential. Some of the habitat components meeting the species requirements are present, and/or only some of the habitat on or adjacent to the site is unsuitable. The species has a moderate probability of being found on the site.
- High Potential. All of the habitat components meeting the species requirements are present and/or most of the habitat on or adjacent to the site is highly suitable. The species has a high probability of being found on the site.
- Present. Species is observed on the site or has been recorded (i.e., CNDDDB, other reports) on the site recently.

The site assessments are intended to identify the presence or absence of suitable habitat for each special-status species known to occur in the vicinity in order to determine its potential to occur in the Study Area. Protocol-level surveys were completed for special-status plants as described below in Section 3.2.3.

In cases where little information is known about species occurrences and habitat requirements, species evaluation was based on best professional judgment of WRA biologists with experience working with the species and habitats. If necessary, recognized experts in individual species biology were contacted to obtain the most up-to-date information regarding species biology and ecology.

If a special-status species was observed during the site visit, its presence was recorded and is discussed below in Section 4.2. For some wildlife species, a site assessment at the level conducted for this report may not be sufficient to determine presence or absence of a species to the specifications of regulatory agencies. In these cases, species were assumed to be present or protocol-level special-status species surveys were conducted. Special-status species that warranted protocol-level surveys, as well as species that further protocol-level surveys, are described below in Section 4.2.

3.2.3 Special-Status Plant Surveys

Protocol-level special-status plant surveys were conducted to locate any special-status plants species present within the Study Area. The CNPS (2001) guidelines state that surveys should be conducted “at the proper time of year when rare, threatened, or endangered species are both evident and identifiable.” Usually, this is when the plants are in bloom; however, there are species that are identifiable outside of the blooming period because non-floral structures (e.g., leaves, roots) are sufficient to make a species determination and/or floral structures (e.g., fruits, buds) are necessary to be in a state of maturity beyond or prior to the documented blooming period. When special-status plants are known to occur in the type(s) of habitats present in the Study Area, nearby accessible occurrences of the plants (reference sites) should be observed to determine that the plants are identifiable at the time of the survey. In addition, the CDFW (CDFW 2018b) and the USFWS (1996) give detailed instructions pertaining to the adequacy of surveys and results.

Floristic-in-nature special-status plant surveys followed the protocol for described in recommended resource agency guidelines (CNPS 2001, CDFW 2018b, USFWS 1996). Special-status plant survey dates corresponded to the peak blooming periods for observing and accurately identifying hundreds of plant species in Solano County, including the 12 species with moderate or high potential to occur in the Study Area. The surveys employed wandering transects across the entirety of the Study Area, with additional effort given to areas thought to be suitable for rare species and sensitive natural communities.

Individuals who conducted the surveys each have formal training in botany and have extensive experience conducting protocol-level rare plant survey in Northern California. The September 20 and 21 surveys were conducted by four-person teams led by Tanner Harris and Scott Batiuk and included fifty-six hours of survey time. The September 29 and October 2 surveys were conducted by two-person teams led by Scott Batiuk and Scott Yarger and included thirty-two hours of survey time.

All plants were identified to the taxonomic level necessary to determine whether or not they were rare using the Jepson eFlora (Jepson Flora Project 2018). Species nomenclature adhered to those provided in the Jepson Flora Project (2018). Sensitive natural communities were identified following *A Manual of California Vegetation, Online Edition* (CNPS 2018a), the CFGC, or other applicable regulations (such as the CWA). Plant surveys were floristic in nature. All observed species were recorded and are included on a comprehensive species list provided in Appendix B. All special-status plant populations and sensitive natural communities were mapped using a handheld Global Positioning System equipment with sub-meter accuracy.

Surveys were conducted on September 20-22 and October 2, 2017, which corresponds to the blooming period for special status plant species with moderate and high potential to occur within the Study Area. Based on-site conditions and habitats observed during these surveys and during wetland delineation surveys conducted April 4 and 5 and May 9, 2019, it was determined that the 17 spring-blooming special-status plant species documented in database searches of the Liberty Island 7.5-minute USGS quadrangle and the eight surrounding USGS quadrangles were unlikely or had no potential to occur within the Study Area; as such, spring special-status plant surveys were determined to be unnecessary and were not conducted. See Section 4.2.1 for additional discussion of the assessment of habitat suitability for special-status plant species within the Study Area.

3.2.4 Special-Status Wildlife Surveys

Following the general wildlife assessment and biological reconnaissance surveys, several focused wildlife and fisheries surveys were performed to better evaluate the potential for special-status wildlife species to occur within the Study Area. The following section describes the general methodology used for the focused wildlife surveys, which included Swainson's hawk (*Buteo swainsoni*), California black rail (CBR; *Laterallus jamaicensis coturniculus*), western pond turtle (*Actinemys marmorata*), giant garter snake (*Thamnophis gigas*), valley elderberry longhorn beetle (*Desmocercus californicus dimorphus*), and general fish assemblage surveys.

Focused surveys for Swainson's hawk were conducted by WRA biologists trained in the species' identification and experienced with the protocol survey methodology. Four Swainson's hawk surveys were conducted in 2018 during the Swainson's hawk nesting season covering Periods II and III of the "Recommended Timing and Methodology for Swainson's Hawk Nesting Surveys in California's Central Valley" (Swainson's Hawk Technical Advisory Committee [SWHA TAC] 2000). Two surveys were conducted in Period II on March 23 and April 4, 2018, and two surveys were conducted in Period III on April 12 and 18, 2018. The survey area included the Study Area and

areas immediately adjacent to the Study Area. Additionally, one survey was conducted on July 28, 2017 in the Phase V survey window, which corresponds to the post-fledging period. The Swainson's hawk survey methods followed the recommendations in the Technical Advisory Committee (TAC) guidelines cited above, and were performed using the naked eye, binoculars, and spotting scopes.

A dedicated assessment and reconnaissance survey for the state-listed CBR was performed on April 18, 2018 from 7:00 AM to 10:35 AM. Survey methods generally followed the "PRBO Black Rail Survey Protocol" by Jules Evens (unpublished). Eleven separate survey stations in the southernmost portion of the Study Area were visited. These stations were selected specifically to cover wetland habitats assessed to have the highest potential to support CBR (e.g., freshwater perennial emergent marsh and the more densely vegetated portions of managed wetlands). These stations were situated along an existing road or roadbed. Following five minutes of passive listening at each station, the surveyor broadcast approximately one minute of black rail "kik-kik-kerr" and "grrr" vocalizations, which was followed by several minutes of passive listening. A minimum of ten minutes was spent at each station. Calls were broadcast using a Domon IP65 portable speaker. The location of any CBRs detected was recorded via directional bearing and estimated distance from the listening station. This survey was performed by a WRA biologist with the appropriate authorization from the CDFW (Memorandum of Understanding under Scientific Collecting Permit No. # SC-9777).

Focused surveys to evaluate habitat for giant garter snake and western pond turtle, and to collect environmental DNA (eDNA) samples for giant garter snake, were performed on July 28, 2017. Two WRA biologists trained in eDNA sampling methodology collected water samples within the Bowsbey Ranch portion of the Study Area on this date. Collection procedures followed Blankenship and Schumer (2016) and Bergman et al. (2016). Water collection samples for eDNA were obtained from four locations. Sample locations were associated with three water features distributed throughout Bowsbey Ranch, including Sycamore Slough, toe drains along Lookout Slough, and Duck Slough. To ensure enough water was filtered at each location, each eDNA sample was represented by two sterivex filters. Total water volume filtered at each location was dictated by the water quality at the time of sampling. The volume of water that was filtered was recorded for each sterivex filter. All sterivex filters or eDNA samples were sent to and processed by Genidaqs using a quantitative Polymerase Chain Reaction (qPCR) hardware platform.

Focused surveys for valley elderberry longhorn beetle and the species host plant were conducted in the Study Area by WRA biologists on August 27 and September 7, 2018, and were supplemented with the special-status plant surveys referenced in Section 3.2.3. Surveys followed USFWS 2017 *Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle*; which included the preliminary surveys to identification elderberry host plants within the Study Area, a survey of all habitat and elderberry plants within 50 meters (165 feet) of host plants found within the Study Area, and an examination of elderberry stems for exit holes and presence of the beetle. Elderberry host plants were photographed and their locations were recorded.

General fish assemblage surveys were conducted within canals, ponds, and sloughs interior to the surrounding levee system in the Study Area. Three WRA fisheries biologists conducted fish assemblage surveys on March 8 and 9, 2018. All sampled features are isolated from the external Cache Slough area and have been artificially constructed or manipulated. Additionally, they are used to convey agricultural and managed water through the Bowsbey and Liberty Farms properties within the Study Area. No areas exterior to the flood control levees were sampled. Fish sampling was conducted via seine net, dip nets, and hook-and-line. Fish sampling was performed opportunistically in an effort to sample representative habitat within each

artificially/managed target feature. Captured fish were identified to the species level and were released back into the water feature they were collected from. General fish size and age class, along with abundance, were qualitatively assessed for each sampled feature. Since the survey objective was to identify representative fish species and existing condition information for the interior Study Area fish assemblage, catch-per-unit effort and population size were not evaluated. In addition to fish species identification, water quality parameters, including temperature and salinity, and estimated water depth were recorded for each aquatic feature that was surveyed.

4.0 RESULTS

The approximately 3,600-acre Study Area is located primarily in unincorporated Solano County, with the northeastern corner located within unincorporated Yolo County, California. The Study Area is situated in the center of the Liberty Island USGS 7.5-minute quadrangle and is composed of three areas: Bowsbey Ranch, Liberty Farms, and the Vogel property (Appendix A, Figure 1, Figure 2). Both Bowsbey Ranch and Liberty Farms are currently protected by a Corps' flood control levee associated with the Yolo Bypass West levee system, whereas Vogel is located outside of a Corps levee. A detailed description of each of these areas is discussed below. The following sections present the results of the biological assessment conducted within the Study Area.

Bowsbey Ranch

Bowsbey Ranch is bordered by Liberty Island Road to the north, by non-tidal waters of Duck Slough to the northwest, by the Vogel property to the south, and by non-tidal waters of Lookout Slough to the southeast and south. Opposite of Lookout Slough, land associated with Liberty Farms occurs to the south and east. Additionally, an existing Corps' flood control levee associated with the Yolo Bypass West levee system separates Bowsbey Ranch from tidal waters of Shag Slough along the northeast perimeter and from tidal waters of Hass and Cache Sloughs (and the Vogel property) along the southwest and south perimeter, respectively. Elevations within Bowsbey Ranch range from approximately 0 to 10 feet (WGS84) above mean sea level (MSL) (Google Earth 2018). Based on historic topographic maps from 1908, 1914, and 1916 (NETR 2018), with the exception of a narrow band along the northwestern boundary, the entirety of Bowsbey Ranch was former freshwater tidal Delta marshland that was historically diked and drained for agricultural production. The small portion that was not historically marshland was also historically converted to agricultural production. All of Bowsbey Ranch has been under some form of agricultural production since the historic conversion, and it is currently managed as irrigated pasture.

Bowsbey Ranch is prime farmland largely utilized for grazing. It is evenly divided into nine agricultural fields, which are separated by earthen access roads and irrigation canals. Concrete v-ditches bisect each field, which are irrigated on a rotating basis throughout the year. Bowsbey Ranch was graded and infrastructure was constructed to provide irrigation for pasture land. The majority of Bowsbey Ranch is characterized by ruderal/agricultural vegetation with some wetland vegetation existing within and along irrigation ditches. The non-tidal Sycamore Slough is encompassed by the southwestern portion of Bowsbey Ranch.

Liberty Farms

Liberty Farms is bordered by tidal waters of Shag Slough to the east, tidal waters of Cache Slough to the south, and non-tidal waters of Lookout Slough to the west and north. Again, a Corps' flood control levee associated with the Yolo Bypass West levee system separates Liberty Farms from adjacent tidal waters associated with Shag Slough to the east and Cache Slough to the south. The Cache Slough Complex, which is situated within the Yolo Bypass, is located to the south and west of Liberty Farms. Bowsbey Ranch is located opposite of Lookout Slough to the north and northeast of Liberty Farms. The CDFW-managed Liberty Island Ecological Reserve occurs opposite of Shag Slough to the east of Liberty Farms. Elevations within Liberty Farms range from approximately 0 to 8 feet (WGS84) above MSL (Google Earth 2018). The entirety of Liberty Farms was former Delta marshland that was historically diked and drained for agricultural production.

Liberty Farms currently consists of land actively managed for duck hunting. With the exceptions of levees, roads, and rural residential structures and buildings, the remainder of the site is flooded annually in late summer and drained in early spring. Water is artificially pumped and gravity fed through a series of ditches. Flood waters persist for a shorter duration in the northern portion than in the remainder of the fields. Duck club waterfowl management operations include growing corn cover crops to provide supplemental food to attract ducks during hunting season, vegetation control methods such as herbicide/pesticide use, disking, and burning, and seasonal wetland draining and rotation.

Liberty Farms is dominated by wetlands in the south and ruderal/agricultural vegetation in the north, with planted windrows scattered within the south and developed areas along the eastern portion.

Vogel

The Vogel property is located south of Bowlsbey Ranch and is surrounded by Cache Slough to the east, south, and west; and Hass Slough to the northwest. Elevations within the Vogel property range from approximately 0 to 8 feet (WGS84) above MSL (Google Earth 2018). It was former Delta marshland that was historically diked and drained for agricultural production.

The Vogel property was designed to be operated for winter duck hunting. The interior was divided into two basins by a central berm. A flood gate that connects to Cache Slough can be operated to flood or drain these areas. A perimeter levee keeps out regular tidal waters, but occasionally is overtopped during elevated water flows. The levee breached in 2017, flooding the fields and resulting in the development of lingering wetland conditions observed in 2018. The property has not been used for duck hunting for at least 5 years. It is currently used for grazing livestock. The majority of the Vogel property is dominated by wetland or ruderal/agricultural vegetation.

4.1 Biological Communities

Table 3 summarizes each biological community type observed in the Study Area. In total, the Study Area contains six biological communities, three of which are sensitive. Non-sensitive biological communities in the Study Area include irrigated pasture, non-native grassland, and developed land cover. The three sensitive biological communities that occur in the Study Area include coastal and valley freshwater marsh, open water, and Great Valley mixed riparian forest. Biological communities that occur in the Study Area are discussed in the following sections. Biological communities within the Study Area are shown on Figure 3 in Appendix A.

Portions of these biological communities have been delineated as features subject to the jurisdiction of the Corps and RWQCB, and therefore these aquatic features are considered sensitive under CEQA. Figure 4 of Appendix A depicts jurisdictional aquatic features within the Study Area. See the Aquatic Resources Delineation Report for the Study Area (WRA 2018) for more detailed information regarding jurisdictional aquatic features.

Table 3. Summary of Biological Communities in the Study Area

Structure	Community ¹	Vegetation Alliance	Sensitive	Acres ²
Tree/Shrub	Great Valley mixed riparian forest	Black willow thickets; Arroyo willow thickets; Valley oak woodland	Yes	35.58
Herb	Coastal and Valley freshwater marsh	Hardstem bulrush marsh; California bulrush marsh; Cattail marshes	Yes	1,127.13
	Irrigated pasture	Perennial rye grass fields; Bent grass-tall fescue meadows	No	1,364.19
	Non-native grassland	Wild oats grasslands; Annual brome grasslands; Perennial rye grass fields; Bent grass-tall fescue meadows	No	487.00
Open Water	Open water	N/A	Yes	329.64
N/A / Herb	Developed	Perennial rye grass fields	No	293.00
Total				3,636.54

¹ Portions of these biological communities have been delineated as features subject to the jurisdiction of the Corps and RWQCB and therefore are considered sensitive under CEQA. See the Aquatic Resources Delineation Report for more information (WRA 2018).

² This table summarizes biological communities within the Study Area and includes areas outside of the property boundary; acreages may not match the aquatic resource delineation that followed property boundaries

4.1.1 Non-Sensitive Biological Communities

Irrigated pasture

Though not described in California vegetation literature, irrigated pasture is a land cover type designation applied to land used primarily for the production of forage and livestock that typically support non-native dominated semi-natural communities that are considered non-sensitive. Irrigated pastures within the Study Area are managed by seeding, grazing, and irrigation and are irrigated on a rotational basis throughout the year. Within the Study Area, this land cover type occurs throughout Bowlsbey Ranch. Dominant and characteristic plant species observed within the irrigated pasture land cover type in the Study Area include the following non-native agricultural and ruderal herbaceous species: dallis grass (*Paspalum dilatatum*), barley (*Hordeum* spp.), clover (*Trifolium* spp.), rabbitsfoot grass (*Polypogon monspeliensis*), Italian ryegrass (*Festuca perennis*; Moderate California Invasive Plant Council

[Cal-IPC] Rating), tall fescue (*Festuca arundinacea*; Moderate Cal-IPC Rating), Bermuda grass (*Cynodon dactylon*; Moderate Cal-IPC Rating), bird's-foot trefoil (*Lotus corniculatus*), perennial pepperweed (*Lepidium latifolium*; High Cal-IPC Rating), narrowleaf plantain (*Plantago lanceolata*), smut grass (*Sporobolus indicus*), wild radish (*Raphanus sativus*), wild fennel (*Foeniculum vulgare*; Moderate Cal-IPC Rating), and bristly ox-tongue (*Helminthotheca echioides*) (Cal-IPC 2018). Occasional generalist native species are present, and in the wettest portions of irrigated pastures, they are sometimes dominant, including iris leaved rush (*Juncus xiphioides*), meadow barley (*Hordeum brachyantherum*), knot grass (*Paspalum distichum*), salt grass (*Distichlis spicata*), and cocklebur (*Xanthium strumarium*).

This biological community does not support floristic communities ranked as sensitive by CDFW and is therefore not considered sensitive under CEQA. However, portions of irrigated pasture are considered irrigated wetland, subject to the jurisdiction of the Corps and RWQCB, and therefore are considered sensitive under CEQA. See the Aquatic Resources Delineation Report for more information on irrigated wetland (WRA 2018).

Non-native grassland

This biological community contains elements of four herbaceous alliances, including perennial rye grass fields (*Lolium perenne* [*Festuca perennis*] Herbaceous Semi-Natural alliance), annual brome grasslands (*Bromus diandrus*, *B. hordeaceus*-*Brachypodium distachyon* Herbaceous Semi-Natural Alliance), wild oats grasslands (*Avena* [*barbata*, *fatua*] Herbaceous Semi-Natural Alliance), and bent grass-tall fescue meadows (*Agrostis* [*gigantea*, *stolonifera*]-*Festuca arundinacea* Herbaceous Semi-Natural Alliance) (Sawyer et al. 2009). Within the Study Area, this community occurs in the northern portion of Liberty Farms, along levee roads, and throughout the Vogel property. At limited locations along Lookout Slough, Himalayan blackberry (*Rubus armeniacus*, Moderate Cal-IPC Rating) is a component of this community. Non-native grassland comprises approximately 13% of the Study Area. Non-native grassland in the Study Area is dominated by non-native annual grasses, such as Italian ryegrass, ripgut brome (*Bromus diandrus*; Moderate Cal-IPC Rating), and soft chess (*Bromus hordeaceus*). Additional species within non-native grassland within the Study Area include: bull thistle (*Cirsium vulgare*; Moderate Cal-IPC Rating), broad leaf filaree (*Erodium botrys*), spring vetch (*Vicia sativa*), wild carrot (*Daucus carota*), wild radish, milk thistle (*Silybum marianum*), Italian thistle (*Carduus pycnocephalus*; Moderate Cal-IPC Rating), red stemmed filaree (*Erodium cicutarium*), mallow (*Malva* sp.), and Canada horseweed (*Erigeron canadensis*) (Cal-IPC 2018). The wettest portions of non-native annual grassland were characterized by primarily non-natives species, such as Italian ryegrass, bristly ox-tongue, swamp grass (*Crypsis schoenoides*), rabbitsfoot grass, and bird's-foot trefoil.

This biological community does not support floristic communities ranked as sensitive by CDFW and is therefore not considered sensitive under CEQA. However, within the Vogel property and northern portions of Liberty Farms, portions of non-native grassland meet wetland criteria and are subject to the jurisdiction of the Corps and RWQCB. Therefore, areas considered managed wetlands are considered sensitive under CEQA. See the Aquatic Resources Delineation Report for more information on managed wetlands (WRA 2018).

Developed

Though not described in the literature, the developed land cover type includes portions of the Study Area that have been highly disturbed or impacted through development, including Bowsbey Ranch facilities such as a barn, livestock complex, and ranch roads. Additional developed land exists within the eastern portion of Liberty Farms associated with active and abandoned duck club facilities. Himalayan blackberry is present around riprap along the exterior sloughs in the developed cover type. Additionally, roads situated atop levees are also classified as developed land cover. Vegetation is often sparse, and where present, it is characterized by non-native species typical of disturbed conditions such as Italian rye grass, bird's-foot trefoil, Mediterranean barley (*Hordeum marinum* ssp. *gussoneanum*), ripgut brome, wild radish, and Italian thistle. Developed land cover comprises approximately 8% of the Study Area.

This biological community is not subject to the jurisdiction of federal, state, or local legislation and is therefore not considered sensitive under CEQA. However, portions of developed land in the Bowsbey Property is considered irrigation ditch, and small portions of the developed land in the northeastern portion of Liberty Farms are considered seasonal wetland, and these areas are subject to the jurisdiction of the Corps and RWQCB. Therefore, areas considered irrigation ditch or seasonal wetland are considered sensitive under CEQA. Please see the Aquatic Resources Delineation Report for more information on irrigation ditch and seasonal wetland (WRA 2018).

4.1.2 Sensitive Biological Communities

Great Valley mixed riparian forest

Within the Study Area, vegetation mapped as Great Valley mixed riparian forest contain elements of several alliances, including arroyo willow thickets (*Salix lasiolepis* Shrubland Alliance) and valley oak woodland (*Quercus lobata* Woodland Alliance), and black willow thickets (*Salix gooddingii* Woodland Alliance) (Sawyer et al. 2009).

Great valley mixed riparian forest comprises less than 1% of the Study Area. This biological community occurs on an island along Cache Slough between the Vogel property and Liberty Farms and scattered along the higher-elevation margins of channels and outboard levees within the Study Area. Particularly, Great Valley mixed riparian forest has established along the non-tidal waters of Lookout Slough that bisect the Study Area. The canopy of this community ranges from open to closed configurations, and areas that comprise the arroyo willow thicket alliance had an average of 72 percent absolute cover of arroyo willow shrubs while the valley oak woodland alliance had 100 percent tree canopy cover predominantly comprised of valley oak and white alder (*Alnus rhombifolia*). Himalayan blackberry dominates the understory of both communities (Cal-IPC 2018) and California wild rose (*Rosa californica*) is occasionally present.

Great Valley mixed riparian forest is comprised of sensitive and non-sensitive alliances including arroyo willow thickets (Rarity Ranking G4 S4), valley oak woodland (Rarity Ranking G3 S3), and black willow thickets (Rarity Ranking G4 S3) indicating that arroyo willow thickets is secure globally and statewide, valley oak woodland is vulnerable globally and statewide, and black willow thickets is secure globally and vulnerable statewide. This biological community may be subject to the jurisdiction of CDFW and the RWQCB and is therefore considered sensitive under CEQA.

Coastal and valley freshwater marsh

Within the Study Area, vegetation mapped as coastal and valley freshwater marsh contains elements of several alliances, including hardstem and California bulrush marshes (*Schoenoplectus [acutus, californicus]* Herbaceous Alliance) and cattail marshes (*Typha [angustifolia, domingensis, latifolia]* Herbaceous Alliance) (Sawyer et al. 2009). Holland (1986)

describes coastal and valley freshwater marsh as dominated by perennial, emergent monocots including these species. Coastal and valley freshwater marsh is situated within the southern portion of Liberty Farms and is actively flooded and drained to support waterfowl. These areas are flooded on an annual basis, from summer to spring, and the vegetation is managed to provide food sources for waterfowl and to create contiguous, heterogeneous habitat by actions such as scraping, or plowing. In late 2005 to early 2006, a variety of willow tree species (*Salix* spp.) were planted along irrigation ditches in Liberty Farms (Google Earth 2018). These trees may have been installed as wind rows and do not represent natural historic conditions in the area. Coastal and valley freshwater marsh comprises approximately 31% of the Study Area. Within this community, hardstem bulrush (*Schoenoplectus acutus*) is dominant or co-dominant with broadleaf cattail (*Typha latifolia*), flat sedge (*Cyperus* spp.), common reed grass (*Phragmites australis*), and Himalayan blackberry. In areas of still water, Pacific mosquito fern (*Azolla filiculoides*) occurs on the water's surface.

Coastal and valley freshwater marsh is comprised of one sensitive vegetation alliance: hardstem and California bulrush marshes (Rarity Ranking GU S3), indicating that this alliance is vulnerable statewide, while globally, it has not been ranked. This biological community is considered sensitive under CEQA, as it is subject to the jurisdiction of the Corps and RWQCB. See the Aquatic Resources Delineation Report for more information on this wetland type (WRA 2018).

Open water

Within the Study Area, open water exists in several different forms, including drainage ditches, irrigation ponds, and sloughs (tidal/non-tidal). Open water comprises approximately 9% of the Study Area. This unvegetated land cover type is not described in Sawyer et al. (2009) or Holland (1986).

Drainage ditches within the Study Area are earthen ditches used to drain agricultural fields on Bowsbey Ranch and convey water to the southern portion of Liberty Farms. These ditches vary in size from approximately 5 feet in width to over 20 feet in width, and have varying water regimes, with some ditches being permanently inundated and others carrying water for only a portion of the year. All ditches are manmade, excavated features connected through a complex network of screw gates and pumps. Although many of the ditches are lined with cattails and hardstem bulrush, they were classified as open water due to the small amount of vegetation relative to the overall size of the features and because vegetation within the ditches is regularly removed through current land use management.

Irrigation ponds within the Study Area include two raised, earthen-lined ponds located on the western side of Bowsbey Ranch. The ponds are supported by earthen berms. Water is pumped into these ponds via two pumps, located in Duck Slough. From the ponds, water is gravity-fed into a network of concrete-lined irrigation ditches where it is diverted to individual pastures for flood irrigation. The ponds are regularly maintained and did not contain vegetation at the time of the surveys.

Sloughs within the Study Area include tidal perennial and non-tidal perennial open water habitat. Tidal perennial open water habitat occurs in the southern portion of the Study Area within Cache and Hass Sloughs, and in the eastern portion of the Study Area within Shag Slough. Non-tidal perennial open water habitat occurs within Duck, Lookout, and Sycamore Sloughs. Both tidal and non-tidal sloughs contain emergent vegetation, such as cattails and hardstem bulrush.

Open waters associated with drainage ditches and irrigation ponds are considered sensitive, as they are jurisdictional of the Corps and RWQCB. Sloughs (tidal/non-tidal) are considered sensitive, as they are jurisdictional of the Corps, RWQCB, and CDFW. See the Aquatic Resources Delineation Report for more information on these wetland types (WRA 2018).

4.2 Special-Status Species

4.2.1 Plants

Based on a review of the resources and databases discussed in Section 3.2.1, 36 special-status plant species have been documented in the Liberty Island 7.5-minute USGS quadrangle and the eight surrounding USGS quadrangles. A total of 19 special-status plant species have been documented in the CNDDDB within a 5-mile radius of the Study Area, as depicted in Figure 5 in Appendix A. Three CNDDDB occurrence records for special status plants are mapped within the Study Area including Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*), Heckard's pepper-grass (*Lepidium latipes* var. *heckardii*), and Mason's lilaeopsis (*Lilaeopsis masonii*).

The potential for these 36 species to occur within the Study Area (Appendix C) was evaluated based on a reconnaissance-level site visit conducted in January 2017 and site wide aquatic resource delineation surveys conducted in the spring of 2018 during the blooming period of spring-blooming special-status plant species. No vernal pool indicator (Keeler-Wolf 1998) species were observed during the wetland surveys which concluded that no vernal pool habitat was present on-site. The wetlands on-site occur at locations that formerly supported tidal freshwater marsh but are now supported by managed irrigation or flooding. Based on these observations, spring-blooming special-status plant species documented in database searches of the vicinity were unlikely or had no potential to occur within the Study Area, and surveys for these species were not necessary. In total, 12 of the 36 species were determined to have moderate or high potential to occur in the Study Area and warranted late-season surveys during their blooming period. These species include the following:

- Watershield (*Brasenia schreberi*); CNPS Rank 2B.3
- Bristly sedge (*Carex comosa*); CNPS Rank 2B.1
- Pappose tarplant (*Centromadia parryi* spp. *parryi*); CNPS Rank 1B.2
- Parry's rough tarplant (*Centromadia parryi* ssp. *rudis*); CNPS Rank 4.2
- Bolander's water-hemlock (*Cicuta maculata* var. *bolanderi*); CNPS Rank 2B.1
- San Joaquin spearscale (*Extriplex joaquinana*); CNPS Rank 1B.2
- Woolly rose-mallow (*Hibiscus lasiocarpus* var. *occidentalis*); CNPS Rank 1B.2
- Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*); CNPS Rank 1B.2
- Mason's lilaeopsis (*Lilaeopsis masonii*); State Listed Rare, CNPS Rank 1B.1
- Delta mudwort (*Limosella australis*); CNPS Rank 2B.1
- Sanford's arrowhead (*Sagittaria sanfordii*); CNPS Rank 1B.2
- Suisun Marsh aster (*Symphotrichum lentum*); CNPS Rank 1B.2

The other 24 special-status species documented in the vicinity of the Study Area were unlikely or had no potential to occur based on the poor quality or lack of the following habitats or site conditions:

- Meadows and seeps: as described by Holland (1986), meadows are characterized by typically short, perennial grasses and other graminoids, sometimes with other forbs. They may be perennially wet or seasonally. Within the Study Area, irrigated pasture may seem

superficially similar to a meadow in that it has an abundance of perennial graminoids and is periodically inundated to saturated. However, these are not remnant native meadows. Irrigated pasture differs most substantially in its hydrologic regime. The year-round, rotating flood irrigation does not mimic any natural system to which native meadow species would be adapted. The landscape is highly altered in that it was historically almost entirely Delta marshland and has since been diked and drained and then graded, greatly reducing the likelihood that native meadow species would be present in the seed bank. Additionally, pastures are seeded with forage species rather than natural meadow species. As a result, the habitat is characterized by primarily non-native species that can tolerate the disturbed habitat and irregular hydrology. Irrigated pastures are unlikely to support special-status species that occur in meadow habitats.

Seeps are characterized by short, perennial herbs in permanently moist seeps. Seeps are absent from the Study Area.

- Valley or foothill grasslands

Non-native grassland areas within the Study Area are not remnant natural systems. In all cases, they occur in highly disturbed, manipulated landscapes. At Liberty Farms, they occur on what historically was diked, drained marshland, both along levee roads and in fields that are artificially flooded from late summer to spring. These fields may also experience other vegetation management activities such as pesticide use, discing, and burning.

At Bowsbey Ranch, grassland occurs as narrow strips only along roads and levees.

On the Vogel property, grassland occurs on what historically was diked, drained marshland on levee roads and in flat fields. It historically was artificially flooded for winter duck hunting, providing an unnatural hydrologic regime that native grassland species are not adapted to. Though artificial flooding has not occurred for several years, the levees are still occasionally overtopped during naturally occurring, elevated water flows.

Because of the irregular hydrologic regime, current site management activities, disturbed conditions, and general lack of historic habitat (i.e. historic marshland, not disturbed-but-recovering historic grassland, which is unlikely to have a seed bank containing native special-status grassland species), non-native grassland provides poor quality habitat and is unlikely to support special-status grassland species except for those that are disturbance-adapted (such as Parry's rough tarplant).

- Vernal pools

Vernal pools are absent from the Study Area. Although seasonally inundated areas are present, nearly all occur under irregular hydrologic regimes (e.g. summer-to-spring flooding at Liberty Farms and year-round rotational flooding at Bowsbey Ranch) that native special-status vernal pool species are not adapted to. As such, these seasonally inundated areas do not provide high-quality habitat and are characterized by primarily non-native species that can tolerate such conditions. As stated above, almost the entirety of the Study Area historically was diked, drained marshland and is unlikely to have a seed bank containing native special-status plant species. Indeed, after site visits during the spring and summer, no vernal pool indicator species (following Keeler-Wolf et al. 1998) were observed. Several species were observed that can occur in vernal pools, but they also commonly occur outside of vernal pools (e.g. Mediterranean barley, swamp grass,

and tall cyperus [*Cyperus eragrostis*]), and their presence is not indicative of vernal pool habitat.

The northeastern portion of Liberty Farms does contain a few small seasonal wetlands that have a natural hydrologic regime. However, these wetlands are located within a highly disturbed area that, like most of the site, historically was diked, drained marshland and is unlikely to have a seed bank containing native special-status plant species. They are dominated by non-native species, and no vernal pool indicator species were observed in these features.

Heckard's pepper-grass (*Lepidium latipes* var. *heckardii*) CNDDDB Occurrence Record #7 is mapped in the Study Area. The occurrence record states "Only source of information for this site is an 1891 Jepson collection. Needs fieldwork". It continues "exact location unknown. Mapped by CNDDDB as best guess along the full extent of Hass Slough". Based on the description of mapping by CNDDDB, this species' classification as a grassland and vernal pool associate, and lack of vernal pool habitat and natural grasslands onsite, potential for occurrence for Heckard's peppergrass is considered unlikely.

- Chaparral
Chaparral habitat is absent from the Study Area.

Additionally, after protocol-level special-status plant surveys were conducted, it was determined that four of the 12 species with high or moderate potential to occur are present in the Study Area. These species are listed below:

- Parry's rough tarplant; CNPS Rank 4.2
- Woolly rose-mallow; CNPS Rank 1B.2
- Mason's lilaeopsis; State Listed Rare, CNPS Rank 1B.1
- Suisun Marsh aster; CNPS Rank 1B.2

The other eight species evaluated as having moderate or high potential to occur prior to the protocol-level special-status plant surveys are described in Appendix C as unlikely to occur despite potentially suitable habitat being present since they were not observed during the appropriately-timed special-status plant surveys. The 12 special-status plant species that were originally believed to have moderate or high potential to occur in the Study Area are discussed below. The location and distribution of species observed during protocol-level special-status plant surveys are shown on Figure 5 in Appendix A.

Special-Status Plant Species Determined to Have Moderate or High Potential to Occur within the Study Area That Were Not Observed

Watershield (*Brasenia schreberi*). CNPS Rank 2B.3. Watershield is a perennial herb in the watershield family (Cabombaceae) that blooms from June to September. It typically occurs in freshwater marshes and swamps at elevations ranging from 99 to 7,260 feet (CNPS 2018b). This species is an OBL plant species (Lichvar et al. 2016). This species is known to occur in marshes, swamps, and wetlands. Known associated species include rushes (*Juncus* spp.), tulle (*Schoenoplectus acutus* var. *occidentalis*), pondweed (*Potamogeton* spp.), and great yellow pond lily (*Nuphar polysepala*) (CDFW 2018a).

This species has been recorded throughout 17 different counties within California: Butte, El Dorado, Fresno, Kern, Lake, Lassen, Mendocino, Nevada, Plumas, Sacramento, Shasta,

Siskiyou, San Joaquin, Sutter, Tehama, Tulare, and Tuolumne Counties (CNPS 2018b). There are no occurrences of watershield within the vicinity of the Study Area (Figure 5, Appendix A) (CDFW 2018a).

Although potentially suitable habitat marsh is present, watershield was not observed during protocol-level special-status plant surveys that occurred within this species' blooming period. Additionally, this species has distinctive foliage and is readily identifiable vegetatively. Thus, because this distinctive, perennial species was not observed, it is assumed to be absent from the Study Area.

Bristly sedge (*Carex comosa*). CNPS Rank 2B.1. Bristly sedge is a perennial herb in the sedge family (Cyperaceae) that blooms from May to September. It typically occurs in coastal prairies, lake margins, marshes, swamps, and valley and foothill grasslands at elevations ranging from 0 to 2,060 feet (CNPS 2018b). This species is an OBL plant species (Lichvar et al. 2016). Known associated species include tall flatsedge, willows, tule, and cattail (CDFW 2018a).

Bristly sedge has been recorded throughout ten different counties within California, including Contra Costa, Lake, Mendocino, Sacramento, San Bernardino, Santa Cruz, San Francisco, Shasta, San Joaquin, and Sonoma Counties (CNPS 2018b). There are no occurrences of bristly sedge within the vicinity of the Study Area (Figure 5, Appendix A) (CDFW 2018a).

Although potentially suitable marsh habitat was present, bristly sedge was not observed during protocol-level special-status plant surveys that occurred within this species' blooming period and during times when it would not have been obscured by high tides. It is a relatively large, perennial species that would have been evident at the time of the surveys. Thus, this species is assumed to be absent from the Study Area.

Pappose tarplant (*Centromadia parryi* ssp. *parryi*). CNPS Rank 1B.2. Pappose tarplant is an annual herb in the sunflower family (Asteraceae) that blooms from May to November. It typically occurs in alkaline soils in chaparral, coastal prairie, meadows, seeps, coastal salt marshes and swamps, and vernal mesic foothill and valley grasslands at elevations ranging from 0 to 1,386 feet (CNPS 2018b). This taxon has not been assigned a wetland indicator status (Lichvar et al. 2016). Known associated species include Italian rye grass, saltgrass, Mediterranean barley, perennial pepperweed, yellow star thistle (*Centaurea solstitialis*), alkali heath (*Frankenia salina*), and brass buttons (*Cotula coronopifolia*) (CDFW 2018a).

This taxon has been recorded in eight different counties within California, including Butte, Colusa, Glenn, Lake, Napa, San Mateo, Solano, and Sonoma Counties (CNPS 2018b). There are no occurrences of this taxon within the vicinity of the Study Area (Figure 5, Appendix A) (CDFW 2018a). The nearest documented occurrences of this taxon are 9 miles away from the Study Area (CDFW 2018a).

Pappose tarplant was not observed during protocol-level special-status plant surveys that occurred within this taxon's blooming period. Although this taxon is disturbance-adapted, and although potentially suitable habitat was present along fence-lines, roads, and levees outside of irregular, managed hydrology, only the closely related Parry's rough tarplant was observed. As such, pappose tarplant is assumed to be absent from the Study Area.

Bolander's water-hemlock (*Cicuta maculata* var. *bolanderi*). CNPS Rank 2B.1. Bolander's water-hemlock is a perennial herb in the carrot family (Apiaceae) that blooms from July to September. It typically occurs in coastal brackish or freshwater marshes and swamps at

elevations ranging from 0 to 660 feet (CNPS 2018b). This species is an OBL plant species (Lichvar et al. 2016). Known associated species include rushes, slough sedge (*Carex obnupta*), bulrush (*Scirpus* spp.), and tule (CDFW 2018a).

This species has been recorded in five different counties within California, including Contra Costa, Marin, Sacramento, Santa Barbara, and Solano Counties (CNPS 2018b). There is one CNDDDB occurrence record (#14) located approximately 6 miles west of the Study Area (Figure 5, Appendix A) (CDFW 2018a).

Although potentially suitable marsh habitat was present, Bolander's water-hemlock was not observed during protocol-level special-status plant surveys that occurred within this species' blooming period. This large, conspicuous, perennial species would have been readily identifiable during the survey. As such, this species is assumed to be absent from the Study Area.

San Joaquin spearscale (*Extriplex joaquinana*). CNPS Rank 1B.2. San Joaquin spearscale is an annual herb in the goosefoot family (Chenopodiaceae) that blooms from April to October. It typically occurs in seasonal alkali sink scrub and wetlands in chenopod scrub, alkali meadow, and valley and foothill grassland habitat at elevations ranging from 0 to 2740 feet (CDFW 2018a, CNPS 2018b). This species is a FACU species (Lichvar et al. 2016). Known associated species include salt grass, alkali heath, docks (*Rumex crispus*, *R. pulcher*), tarplants (*Centromadia parryi*, *C. pungens*), pickleweed (*Salicornia pacifica*), and fat hen (*Atriplex triangularis*) (CDFW 2018a).

This species has been recorded in 15 different counties. There is one CNDDDB occurrence record within a 5-mile radius of the Study Area, with the closest occurrence (#26) located approximately 1.5 miles west of the Study Area (Figure 3, Appendix A) (CDFW 2018a).

Although this taxon is disturbance-adapted, and although potentially suitable habitat was present along fence-lines, roads, and levees outside of irregular, managed hydrology, San Joaquin spearscale was not observed during protocol-level special-status plant surveys that occurred within the period of time this species would have been identifiable. As such, this species is assumed to be absent from the Study Area.

Delta tule pea (*Lathyrus jepsonii* var. *jepsonii*). CNPS Rank 1B.2. Delta tule pea is a perennial herb in the pea family (Fabaceae) that blooms from May to July. It typically occurs in freshwater and brackish marshes and swamps at elevations ranging from 0 to 16 feet (CNPS 2018b). This taxon is an OBL plant species (Lichvar et al. 2016). Known associated species include bulrushes, willows, Mason's lilaepsis, perennial pepperweed, California wild rose, and tall flatsedge (CDFW 2018a).

This taxon has been recorded in seven different counties within California, including Contra Costa, Napa, Sacramento, San Joaquin, Solano, Sonoma, and Yolo Counties (CNPS 2018b). There are eight CNDDDB occurrence records within a 5-mile radius of the Study Area including occurrence (#52) mapped within the Study Area in 1994 along the levee bank of Hass Slough north of the Vogel Property (Figure 5, Appendix A) (CDFW 2018a).

Delta tule pea was not observed during protocol-level special-status plant surveys that occurred within this taxon's blooming period. The mapped location of CNDDDB occurrence #52 is on a Corps flood control levee that presumably receives periodic maintenance. Only the common variety of this species, California tule pea (*L. jepsonii* var. *californicus*), which occurs in similar habitats as Delta tule pea, was observed. Because this conspicuous, perennial taxon was not observed, it is assumed to be absent from the Study Area.

Delta mudwort (*Limosella australis*). CNPS Rank 2B.1. Delta mudwort is a perennial herb in the figwort family (Scrophulariaceae) that blooms from May to August. It typically occurs in riparian scrub, mud banks, marshes and swamps (freshwater or brackish) at elevations ranging from 0 to 10 feet (CNPS 2018b). This species has not been assigned a wetland indicator status (Lichvar et al. 2016). Known associated species include Mason's lilaepsis, bulrushes, willows, rushes, whorled pennywort (*Hydrocotyle verticillata*), and spikesedges (*Eleocharis* spp.) (CDFW 2018a).

This species has been recorded in four different counties within California, including Contra Costa, Sacramento, San Joaquin, and Solano Counties (CNPS 2018b). There are three CNDDDB occurrence records in the vicinity of the Study Area (CDFW 2018a). The nearest documented occurrence is from August 1986, located at the confluence of Miner Slough and Cache Slough south of Liberty Island (Figure 5, Appendix A) (CDFW 2018a).

Delta mudwort was not observed during protocol-level special-status plant surveys that occurred during the period of time when this species would have been identifiable and would not have been submerged by the tide. This species occurs on muddy banks in the intertidal zone, and the only potential habitat would be on the outboard side of the Vogel property levee, where it could be expected to co-occur with Mason's lilaepsis. Because the perennial species was not observed, it is assumed to be absent from the Study Area.

Sanford's arrowhead (*Sagittaria sanfordii*). CNPS Rank 1B.2. Sanford's arrowhead is a perennial herb in the water plantain family (Alismataceae) that blooms from May to October. It typically occurs in assorted shallow freshwater habitats, such as marshes and swamps at elevations ranging from 0 to 1,430 feet (CNPS 2018b). This species is an OBL plant species (Lichvar et al. 2016). Known associated species include hardstem bulrush, common rush, willows, floating primrose-willow (*Ludwigia peploides*), flat sedge, cockspur grass (*Echinochloa crus-galli*), and sprangletop (*Leptochloa fusca*) (CDFW 2018a).

This species has been recorded in 19 different counties within California, including Butte, Del Norte, El Dorado, Fresno, Merced, Mariposa, Marin, Napa, Orange, Placer, Sacramento, San Bernardino, Shasta, San Joaquin, Solano, Tehama, Tulare, Ventura, and Yuba Counties (CNPS 2018b). There are four CNDDDB occurrence records in the vicinity of the Study Area (CDFW 2018a). The nearest documented occurrence is from August 2005, located in Miner Slough on the east side of Prospect Island (Figure 5, Appendix A) (CDFW 2018a).

Although potentially suitable habitat was present, Sanford's arrowhead was not observed during protocol-level special-status plant surveys that occurred within this species' blooming period and times when it would not have been obscured by the tide. Because this conspicuous, perennial species was not observed, it assumed to be absent from the Study Area.

Special-Status Plant Species Observed in the Study Area

Parry's rough tarplant (*Centromadia parryi* ssp. *rudis*). CNPS Rank 4.2. Parry's rough tarplant is an annual herb in the sunflower family (Asteraceae) that blooms from May to October. It typically occurs in alkaline, vernal mesic valley and foothill grasslands and vernal pools and seeps, and sometimes along roadsides at elevations ranging from 0 to 330 feet (CDFW 2018a, CNPS 2018b). This is a FACW taxon (Lichvar et al. 2016). Known associated species include pappose tarplant, yellow dock, hayfield tarplant (*Hemizonia congesta*), Mediterranean barley (*Hordeum murinum*), common lippia (*Phyla nodiflora*), saltgrass, narrowleaf milkweed (*Asclepias*

fascicularis), alkali mallow (*Malvella leprosa*), cutleaf plantain (*Plantago coronopus*), and sundry annual grasses (CDFW 2018a).

This taxon has been recorded in 35 different counties within California, including Butte, Colusa, Glenn, Lake, Merced, Sacramento, San Joaquin, Solano, Sutter, and Yolo Counties (CNPS 2018b). Rank 4 taxa are not displayed in CNDDDB database search results; however, this species has been recorded within five of the surrounding eight quadrangles by the CNPS (2018b).

Parry's rough tarplant was present within the Study Area. Approximately 348 individuals were observed on and adjacent to levee roads within the non-native grassland community on Bowsbey Ranch and ten individuals at were observed at one location (alongside a levee road in the same biological community) on the Vogel property. Individuals were found along fence lines and along both gravel and dirt access roads. Locations of individuals observed are shown on Figure 6 in Appendix A.

Woolly rose-mallow (*Hibiscus lasiocarpus* var. *occidentalis*). CNPS Rank 1B.2. Woolly rose-mallow is a perennial herb in the mallow family (Malvaceae) that blooms from June to September. It typically occurs in freshwater marshes and swamps, often within riprap on the sides of levees at elevations ranging from 0 to 394 feet (CDFW 2018a, CNPS 2018b, and CDFW 2018a). This species has no wetland indicator status (Lichvar et al. 2016). Associated species include cattail, club-rush, knotweeds, and willows (CDFW 2018a, CDFW 2018a).

This species has been recorded in 36 different counties within California, including Butte, Contra Costa, Colusa, Glenn, Sacramento, San Joaquin, Solano, Sutter, and Yolo Counties (CNPS 2018b). There are two CNDDDB records (#142 and #223) located within a 5-mile radius of the Study Area (CDFW 2018a). The nearest documented occurrence was last observed in August of 2005 and is located along the southern edge of Hass Slough (Figure 5, Appendix A) (CDFW 2018a).

Woolly rose-mallow was present within the Study Area. In total, approximately 80 individuals were observed among emergent vegetation located along the eastern bank of Sycamore Slough in the southwestern portion of Bowsbey Ranch. Locations of individuals observed are shown on Figure 6 in Appendix A.

Mason's lilaopsis (*Lilaopsis masonii*). State Listed Rare. CNPS Rank 1B.1. Mason's lilaopsis is a rhizomatous, tuft-forming, diminutive perennial forb in the carrot family (Apiaceae) that blooms from April to November. It typically occurs in areas within the direct tidal or splash zones on mud banks of sloughs and channels in riparian scrub and freshwater and brackish marsh habitat at elevations ranging from 0 to 35 feet (CDFW 2018a, CNPS 2018b). This species is an OBL plant species (Lichvar et al. 2016). Associated species include Baltic rush, low bulrush (*Isolepis cernua*), tule, cattails, common reed, fleshy jaumea (*Jaumea carnosa*), salt grass, fat hen (*Atriplex prostrata*), arrow grasses (*Triglochin* spp.), water parsley (*Oenanthe sarmentosa*), gumweed (*Grindelia* spp.), and pickleweed (CDFW 2018a).

This species has been recorded in 24 different counties within Alameda, Contra Costa, Marin, Napa, Sacramento, San Joaquin, Solano, and Yolo Counties (CNPS 2018b). There are 18 CNDDDB occurrence records in the vicinity of the Study Area (CDFW 2018A)) including records 72 and 73 mapped within the Study Area in 2005 on the Vogel Property and to the northwest along Hass Slough (Figure 5, Appendix A) (CDFW 2018a).

Mason's lilaepsis was present within the Study Area. Approximately 12 colonies were observed on the outboard side of levees within the tidal zone of the Vogel property. Mason's lilaepsis was observed growing often in dense patches where it was the dominant species, though it was also observed growing amongst other species as a subdominant. In some locations, it co-occurred with Suisun Marsh aster.

As stated above, Mason's lilaepsis is rhizomatous, and it produces tufts at intervals along the rhizomes. As such, it would not be possible to estimate the number of individuals without digging the plants up. Instead, the dimensions of the area occupied at each occurrence were estimated, as were the density of tufts per square foot. The area occupied by each occurrence ranged from 2 to 35 square feet. Densities ranged from 50 to 155 tufts per square foot. Locations of occurrences observed are shown on Figure 6 in Appendix A.

Suisun Marsh aster (*Symphyotrichum lentum*). CNPS Rank 1B.2. Suisun Marsh aster is a perennial forb in the sunflower family (Asteraceae) that blooms from May to November. It typically occurs along sloughs and channels in dense marsh vegetation in freshwater and coastal brackish marsh habitat at elevations ranging from 0 to 10 feet (CDFW 2018a, CNPS 2018b). This species is an OBL plant species (Lichvar et al. 2016). Known associated species include gumweed, western goldenrod (*Euthamia occidentalis*), Delta tule pea, cattails, hardstem bulrush, Olney's bulrush (*Schoenoplectus americanus*), California tule, Baltic rush, marsh fleabane (*Pluchea odorata*), California wild rose, and common reed (CDFW 2018a).

This species has been recorded in 26 different counties within Contra Costa, Napa, Sacramento, San Joaquin, Solano, and Yolo counties (CNPS 2018b). Thirty CNDDDB occurrence records occur in the vicinity of the Study Area (CDFW 2018a). The nearest colony of Suisun Marsh aster is located approximately 0.4 mile southwest of the Study Area (CNDDDB occurrence #193). This occurrence was last observed in 2008 and contained three robust patches of individuals (CDFW 2018a). Additionally, two colonies of Suisun Marsh aster (CNDDDB occurrences #191 and #192) are located approximately 0.6 and 0.7 mile northwest of the Study Area, respectively (CDFW 2018a). These colonies are located among emergent tidal marsh vegetation along Hass Slough and are presumed extant (though abundance estimations in these colonies were not recorded).

Suisun Marsh aster was present within the Study Area. Approximately 241 individuals of Suisun Marsh aster were observed in the Study Area. In total, 216 individuals were observed on the outboard side of the levee that parallels Shag Slough. The remaining 27 individuals of Suisun Marsh aster were observed on the outboard side of the levee that surrounds the Vogel property. Suisun Marsh aster was found alongside Mason's lilaepsis. Locations of individuals observed are shown on Figure 6 in Appendix A.

4.2.2 Wildlife

Based upon a review of the available resources, 90 special-status wildlife species have been documented in the vicinity of the Study Area. Of these, 25 special-status wildlife species were observed within, or have a moderate or high potential to occur in the Study Area. All species with potential to occur, or that are known to occur, are discussed below. Any wildlife species observed have been recorded in Appendix B. Appendix C summarizes the potential for all species evaluated within the Study Area. A total of 19 special-status wildlife species have been documented in the CNDDDB within a 5-mile radius of the Study Area, as depicted in Figure 6 in Appendix A. Of the 90 special-status wildlife species documented in the vicinity of the Study Area, the majority of species have no potential or are unlikely to occur due to a lack of suitable habitat

or habitat components. Some of those habitats and components, which are not present within the Study Area, include:

- vernal pools
- ground squirrels or their burrows
- caves or rock outcroppings
- oak woodlands
- suitable soils to support host plants
- species-specific host plants
- beaches or dune habitats
- salt marsh
- suitable old growth riparian forest

In addition to the aforementioned resources, WRA also conducted a series of wildlife surveys within the Study Area (Table 4).

Table 4. Wildlife Surveys Conducted within the Study Area

Target Species or Taxa	Survey Dates	Results
General Fish Assemblage	March 8 and 9, 2018	No federal or state listed species observed. One individual splittail was the only special-status fish documented in the Study Area. Aquatic features were dominated by non-native fish. A full list of fish encountered is provided in Appendix B.
Swainson's Hawk and Nesting Raptors	March 23 – April 18, 2018	Two nests were observed within the Study Area and two nests were observed outside of it (within 500 feet of the boundary).
Giant Garter Snake eDNA survey	July 28, 2017	eDNA for this species was detected in toe drains along Lookout Slough and in Sycamore Slough.
California Black Rail Habitat Assessment and Reconnaissance Survey	April 18, 2018	Habitat was found to be not suitable and no individuals were detected.
Valley Elderberry Longhorn Beetle	August 27 and September 7, 2018	Five elderberry shrubs and two saplings were found on the outboard side of the levee. Plants were not part of a continuous or remnant riparian corridor; the area is subject to levee maintenance. No exit holes or beetles were observed on stems.

Species that were determined to have a moderate or high potential, or are known to occur within the Study Area are discussed below, which is followed by a discussion of federally listed species known in the area, but are not likely to occur within the Study Area.

Species Considered Present within the Study Area

Giant garter snake (*Thamnophis gigas*). State Threatened Species, Federal Threatened Species. This endemic species of snake is found only in the Sacramento and San Joaquin Valleys. Giant garter snake prefers freshwater marshes and low gradient streams, but has adapted to drainage channels and irrigation ditches. Giant garter snake inhabits agricultural wetlands and other waterways, such as irrigation and drainage canals, sloughs, ponds, small lakes, low gradient streams, and adjacent uplands in the Central Valley.

Giant garter snake is active when water temperatures are approximately 20°C or more. It is dormant underground in winter, but also uses underground refugia throughout its active season. Fish and frogs form a large portion of the diet of this species. This highly aquatic snake is active during daylight and at night, temperatures permitting. It uses vegetation near water for basking, but is evasive and difficult to approach. Giant garter snake will quickly submerge into the water from its basking site when startled. This species hibernates in animal burrows in the winter and typically emerges from overwintering sites in March to April based on air temperatures and breeds upon emergence, breeding typically through May. It does not typically enter water for foraging or other activities until mid-April or May when water has warmed to a sufficient temperature.

This species was previously believed to be extirpated from the adjacent Liberty Island area of the Delta (USFWS 2012). However, a specimen was recorded along the southeastern border of the Study Area in 2017 (CDFW 2018a). Additionally, WRA passively sampled Environmental DNA (eDNA) from this species in Bowsbey Ranch. Furthermore, in 2018 and 2019, the USGS conducted trapping surveys for giant garter snake within the Study Area. While the survey results have not been finalized or released at this time, WRA biologists accompanied the USGS for a day of trapping, during which time it was confirmed that giant garter snake had been captured in both years. Therefore, this species is considered present within the Study Area.

Loggerhead shrike (*Lanius ludovicianus*). USFWS Bird of Conservation Concern, CDFW Species of Special Concern. The loggerhead shrike is a year-round resident and winter visitor in lowlands and foothills throughout California. This species is associated with open country with short vegetation and scattered trees, shrubs, fences, utility lines, and/or other perches. Although they are songbirds, shrikes are predatory and forage on a variety of invertebrates and small vertebrates. Captured prey items are often impaled on suitable substrates for storage purposes, including thorns or spikes on vegetation, and barbed wire fences. Nests are located in trees and large shrubs. Nests are usually placed 3 to 10 feet off the ground (Shuford and Gardali 2008).

This species was observed within the Study Area during the January 6, 2017 site visit. The Study Area contains short-statured grasslands suitable for foraging by the species. In addition, trees, shrubs, and other suitable vegetation is present along levees or in scattered patches around the Study Area, which may support nesting by the species. The species has been observed within the Study Area, and both foraging and nesting habitat are present. This species was determined to have high potential to nest within the Study Area.

Northern harrier (*Circus cyaneus*). CDFW Species of Special Concern. The northern harrier is a resident within and winter visitor to open habitats throughout most of California, including freshwater and brackish marshes, grasslands and fields, agricultural areas, and deserts. Harriers typically nest in treeless areas within patches of dense, relatively tall vegetation that varies in composition. Nests are constructed on the ground and are often located near water or within wetlands (Shuford and Gardali 2008). Harriers are birds of prey that subsist on a variety of small mammals and other vertebrates.

Open areas composed of shrubby vegetation in close proximity to marsh and foraging habitat create potential nesting habitat for the northern harrier. This species has been observed foraging in and adjacent to the Study Area. While agricultural disturbance may degrade portions of the nesting habitat, the large scale of the Study Area, which contains contiguous and open non-wooded habitats, provides a high potential for this species to nest.

Sacramento splittail (*Pogonichthys macrolepidotus*). CDFW Species of Special Concern. Splittail are primarily freshwater fish that have been found mostly in slow-moving sections of rivers and sloughs. In the Delta and Suisun Marsh, they often congregate in dead end sloughs (Moyle et al. 1982, Daniels and Moyle 1983). Splittail are benthic foragers that feed extensively on opossum shrimp (*Neomysis mercedis*). However, detrital material typically comprises a high percentage of their stomach contents. They will feed opportunistically on earthworms, clams, insect larvae, and other invertebrates. They are preyed upon by striped bass and other predatory fish. Splittail ostensibly require flooded vegetation for spawning and as foraging areas for young, hence they are found in habitat subject to periodic flooding during the breeding season (Caywood 1974).

Aquatic habitat surrounding the Study Area is composed of slow-moving tidal sloughs, which are suitable for both foraging and spawning by the species (Young et al. 2015, Calfish 2018). Surveys conducted by University of California, Davis have documented this species within the surrounding Cache Slough Complex (Young et al. 2015). Additionally, during aquatic surveys throughout the irrigation ditches of the Study Area, an individual of this species was observed. Therefore, as Sacramento splittail is known to occur in the habitats that surround the Study Area and was detected within the Study Area, it is considered present.

Song sparrow - Modesto Population (*Melospiza melodia*). CDFW Species of Special Concern. The Modesto population of the song sparrow is endemic to the north-central portion of the Central Valley. The highest densities of this species occur in the Butte Sink area. This song sparrow has an affinity for emergent freshwater marshes, but will also nest in willow thickets, valley oak riparian forests, and along vegetated irrigation ditches and levees.

This species has been recorded in marshes within 5-miles to the south of the Study Area (CDFW 2018a), and song sparrows have been observed within the Study Area during site visits by WRA. Additionally, marshes within the southern section of the Study Area have been managed as a duck hunting club and may provide suitable nesting and foraging habitat for the species. Therefore, due to the proximity of occurrences and observations on-site, as well as the presence of marsh habitat, this species was determined to be present within the Study Area.

Swainson's hawk (*Buteo swainsoni*). State Threatened, USFWS Bird of Conservation Concern. Swainson's hawk is a summer resident and migrant in California's Central Valley and in scattered portions of the southern California interior. Nests are constructed of sticks and are placed in trees located in otherwise largely open areas. Areas typically used for nesting include the edge of narrow bands of riparian vegetation, isolated patches of oak woodland, lone trees, and both planted and natural trees associated with roads, farmyards, and sometimes adjacent residential areas. Foraging occurs in open habitats, including grasslands, open woodlands, and agricultural areas. While breeding, adults feed primarily on rodents (and other vertebrates). For the remainder of the year, large insects (e.g., grasshoppers, dragonflies) comprise most of this species' diet. In many areas, Swainson's hawks have adapted to foraging primarily in and around agricultural plots (particularly alfalfa, wheat and row crops), as prey are both numerous and conspicuous at harvest and/or during flooding or burning (Bechard et al. 2010).

During the survey conducted by WRA in the spring of 2018, two nests associated with this species

were observed within the Study Area (Figure 6, Appendix A). Additionally, two nests were observed outside of the Study Area, within approximately 500 feet of the Study Area boundary. A nest for this species was also recorded from 2001-2005 and in 2007 (CNDDDB Occurrence 1148, CDFW 2018a). Swainson's hawk show nest site fidelity and will return to the nest territory each year to nest in the same or proximate tree. One of the nests detected in 2018 surveys is immediately adjacent to the 2001-2005/2007 location (occurrence #1148) and is assumed to be the current nest location for this territory and CNDDDB nest occurrence. This species is considered present in the Study Area because it was observed nesting during cursory surveys.

Western pond turtle (*Actinemys marmorata*). CDFW Species of Special Concern. This turtle can be found in suitable aquatic habitat throughout California, west of the Sierra-Cascade crest and Transverse Ranges. Pond turtles inhabit perennial aquatic habitats, such as lakes, ponds, rivers, streams, and canals that provide submerged cover and suitable basking structures, such as rocks and logs (Zeiner et al. 1990). Pond turtles prefer to nest on unshaded upland slopes close to their aquatic habitat, and hatchlings require shallow water with relatively dense emergent and submerged vegetation for aquatic invertebrate foraging (Thompson et al. 2016). Within the Delta, pond turtle is typically found where suitable basking sites, deep water, and friable soils occur together.

This species was observed within the Study Area and in the adjacent waters of the Cache Sough Complex. The presence of deep water found in irrigation ditches and in Sycamore Slough, combined with multiple sloughs surrounding the Study Area, provides an abundance of suitable habitat within and surrounding the Study Area. Additionally, the Study Area provides suitable basking sites and friable soils capable of supporting reproduction for this species. Therefore, this species is considered present within the Study Area.

Species with High Potential to Occur within the Study Area

Chinook salmon - Central Valley Fall/late fall-run, Evolutionarily Significant Unit (ESU) (*Oncorhynchus tshawytscha*). NMFS Species of Concern, CDFW Species of Special Concern. The Central Valley fall/late fall-run ESU includes all naturally spawned spring-run Chinook salmon populations from the Sacramento/San Joaquin River mainstem and its tributaries. Late-fall run Chinook salmon are morphologically similar to spring-run Chinook salmon. They are large salmonids, reaching 75-100 cm standard length and weighing 9-10 kilograms or more. The vast majority of late-fall Chinook salmon appear to spawn in the mainstem of the Sacramento River, which they enter from October through February. Spawning occurs in January, February and March, although it may extend into April in some years. Eggs are laid in large depressions (redds) hollowed out in gravel beds. The embryos hatch following a 3-4 month incubation period and the alevins (sac-fry) remain in the gravel for another 2-3 weeks. Once their yolk sac is absorbed, the fry emerge and begin feeding on aquatic insects. All fry have emerged by early June. The juveniles hold in the river for nearly a year before migrating to the ocean the following December through March. Once in the ocean, salmon are largely piscivorous and grow rapidly. The specific habitat requirements of late-fall Chinook salmon have not been determined, but they are presumably similar to other Chinook salmon runs and fall within the range of the physical and chemical characteristics of the Sacramento River above Red Bluff.

The Study Area is located directly off of the primary migration corridors (the Sacramento River and the Sacramento River Deep Water Shipping Channel [DWSC]) used by this species when migrating to the American, Sacramento, or Fall River spawning grounds (Moyle 2002). While adults do not typically use sloughs or marshes like those surrounding the Study Area during migration, juvenile salmonids require such habitats for rearing, and as cover during outmigration

(Meyers et al. 1998). Fish rescue operations at the Yolo Bypass have identified this species as being present in the local area (Acierto et al. 2014). Therefore, due to the presence of habitat within and surrounding the Study Area, as well as the proximity to the migration corridors used by salmonids moving through the Sacramento River, this species was determined to have high potential to be seasonally present, particularly during the outmigration period of juvenile fish.

Chinook salmon - Central Valley Spring-run ESU (*Oncorhynchus tshawytscha*). Federal Threatened, State Threatened. The Central Valley Spring-run ESU includes all naturally spawned spring-run populations from the Sacramento/San Joaquin River mainstem and its tributaries. Chinook salmon are anadromous (adults migrate from a marine environment into the freshwater streams and rivers of their birth) and semelparous (spawn only once and then die). Spring-run Chinook salmon enter the Sacramento River between February and June. They move upstream and enter tributary streams from February through July, peaking in May-June. These fish migrate into the headwaters, hold in pools until they spawn, starting as early as mid-August and ending in mid-October, peaking in September. They are fairly faithful to the home streams in which they were spawned, using visual and chemical cues to locate these streams. While migrating and holding in the river, spring chinook do not feed, relying instead on stored body fat reserves for maintenance and gonadal maturation. Eggs are laid in large depressions (redds) hollowed out in gravel beds. Some fish remain in the stream until the following October and emigrate as "yearlings", usually at the onset of storms starting in October and lasting through the following March (peaking in November-December). Large pools with cold water provide essential over-summering habitat for this species.

The Study Area is located directly adjacent to the primary migration corridors (the Sacramento River and the DWSC) used by this species (NMFS 2016b). While adults do not typically use sloughs and marshes like those surrounding the Study Area during migration, juvenile salmonids require such habitat for rearing, and as cover during outmigration (NMFS 2016b). Spring Kodiak trawl data from the CDFW operations south of Liberty Island, as well as fish rescue operations in the Yolo Bypass, have confirmed the presence of this species throughout the local area (CDFW 2018c, Acierto et al. 2014). Therefore, due to: (1) the presence of suitable rearing and foraging habitat within and surrounding the Study Area, (2) the proximity to primary migration corridors used by Chinook salmon moving through the Sacramento River, and (3) confirmed occurrences of Chinook salmon in the local area, this species was determined to have a high potential to be seasonally present, particularly during the outmigration period of juvenile fish.

Chinook salmon - Sacramento River Winter-run ESU (*Oncorhynchus tshawytscha*). Federal Endangered, State Endangered. The ESU includes all naturally spawned populations of winter-run Chinook salmon in the Sacramento River and its tributaries in California, as well as two artificial propagation programs: winter-run Chinook salmon from the Livingston Stone National Fish Hatchery (NFH), and winter-run Chinook salmon in a captive broodstock program maintained at Livingston Stone NFH and at the University of California Bodega Marine Laboratory. Winter-run chinook salmon are unique because they spawn during summer months when air temperatures usually approach their yearly maximum. As a result, these salmon require stream reaches with cold water sources that will protect embryos and juveniles from the warm ambient conditions in summer. Winter-run chinook salmon are primarily restricted to the mainstem Sacramento River.

The Study Area is located directly off of the primary migration corridors (the Sacramento River and the DWSC) used by this species (NMFS 2014). While adults do not typically use sloughs and marshes like those surrounding the Study Area during migration, juvenile salmonids require such habitat for rearing, and as cover during outmigration (NMFS 2014, Moyle 2002). This

species has been detected during CDFW Kodiak trawls south of Liberty Island, as well as during fish salvage operations within the Yolo Bypass (CDFW 2018c, Acierto et al. 2014). Therefore, due to the presence of rearing and foraging habitat within and surrounding the Study Area, as well as the proximity to this species' primary migration corridor, and the recorded occurrences of the species within adjacent waters, this species was determined to have high potential to be seasonally present, particularly during the outmigration period of juvenile fishes.

Delta smelt (*Hypomesus transpacificus*). Federal Endangered, State Threatened. Delta smelt are a pelagic species (i.e., they spend their lives within the water column and are not associated with a structural physical habitat). All life stages of Delta smelt generally occur within two meters of the surface and tend to concentrate near the mixing zone where salinities of 2 parts per 1,000 (ppt) occur (USFWS 2003). The point in the estuary where the average daily salinity at the bottom of the water is two ppt is referred to as the X2. This is the distance from the Low Salinity Zone (about 0.6 to 3.0 ppt) to the Golden Gate Bridge, measured in kilometers (USFWS 2008). This distance changes over the course of the year based on freshwater inflow through the Delta, and during years when the X2 is centered around the shallows of Suisun Bay during the spring generally result in high abundance of Delta smelt in the fall (USFWS 2003).

The only known important physical habitat for Delta smelt occurs during spawning, when suitable spawning substrate is required. Suitable spawning habitat is composed of open, unvegetated, shallow subtidal (less than 3 meters) waters with sand or pebble-sized substrate found within freshwater sloughs (USFWS 2008, Moyle 2002). Most spawning is believed to occur at temperatures between 7 and 15 degrees Celsius (USFWS 2003). Smelt are broadcast spawners with demersal, or bottom-sinking, fertilized eggs that adhere to pebble or sand substrate to keep them from washing away and to allow them to "tumble incubate" with wave movement (USFWS 2008). Spawning generally occurs during the late winter and spring months, with peak spawning activity occurring in April and May (Moyle 2002). Adults migrate to more freshwater environments of the upper Delta, where they seek sloughs and shallow edge areas. Most spawning occurs within the upper Delta and in the Sacramento River above Rio Vista (Moyle 2002). Spawning locations are inferred by the locations of captured gravid females, spent females, and larvae in trawl samples. Wet years, in which higher levels of freshwater are moving through the Delta system, appear to result in a greater abundance and distribution of smelt in the following year (USFWS 2003). Larvae hatch in 10 to 14 days, are planktonic (float with the water currents), and are washed downstream until they reach areas near the X2. Delta smelt are fast-growing and short-lived, with the majority of growth occurring within the first 7 to 9 months of life. Throughout their lifespan, this species feeds entirely on zooplankton (USFWS 2008).

The area surrounding Liberty Island, as well as the Cache Slough Complex, are known to support Delta smelt spawning and rearing habitat (DWR 2015, Bennett 2005, USFWS 1996). A small portion of the Delta smelt population is believed to inhabit the Cache Slough Complex year-round (Bennett 2005). Data from CDFW trawls also support this information. Trawl Station 716 is located at the southern end of Liberty Island and data collected from this location confirm that adult, juvenile, and larval smelt have been consistently detected in this area (CDFW 2018c). Given the confirmed presence of the species immediately downstream of the Study Area, as well as at Liberty Island which borders the Study Area to the east, this species is considered present in the surrounding sloughs and was determined to have high potential to occur adjacent to and within the Vogel portion of the Study Area during flood events.

Green sturgeon - Southern DPS (*Acipenser medirostris*). Federal Threatened. The southernmost spawning population of green sturgeon is in the Sacramento River, with the principal spawning area located in the lower Feather River (Moyle 2002). Spawning populations

of green sturgeon in the San Joaquin River are presumed to have been extirpated in the past 25-30 years. Green sturgeon are primarily marine species, entering into freshwater rivers mainly to spawn, although early life stages may reside in freshwater for up to two years (Moyle 2002). Adults typically migrate into freshwater from late February through late July. The spawning period occurs from March to July, with peak spawning occurring from mid-April to mid-June (Emmett et al. 1991). Green sturgeon prefer deep pools in large, turbulent, freshwater river mainstreams to spawn (Moyle et al. 1992). Juvenile green sturgeon migrate to the ocean primarily during the summer and fall before the end of their second year (Emmett et al. 1991). Green sturgeon adults, subadults, and juveniles are widely distributed throughout the Delta and estuary. Adults typically migrate upstream on the western edge of the Delta, returning to the ocean when river temperatures decrease and flows increase during the fall and early winter. They may hold in low gradient or off-channel sloughs or coves where temperatures are within acceptable thresholds. Larvae prefer open aquatic habitats for foraging, but utilize structure habitat during the day. Juvenile rearing habitats for green sturgeon include spawning areas and migration corridors. Rearing habitat utilization varies depending on seasonal flows and temperatures. Juvenile green sturgeon are found year-round in the Delta and use the region as a migration corridor, feeding area, and juvenile rearing area (Lindley et al. 2011, Moyle 2002). Green sturgeon are salvaged at the CVP and SWP pumping plants on an irregular basis throughout the year, verifying their presence in the south Delta (EPIC et al. 2001).

Juvenile green sturgeon use the Delta as a migration corridor, as well as for feeding and rearing habitat (NMFS 2015, Lindley et al. 2011, Moyle 2002). The primary migration corridors for this species include the Sacramento River, the DWSC, and the Yolo Bypass, all of which converge near the southern end of the Study Area (NMFS 2015, DWR 2012). Due to difficulties associated with catching, tagging, and tracking this species, records are difficult to obtain. However, during flooding within the Yolo Bypass, green sturgeon are typically stranded and rescued, therefore this represents the nearest confirmed occurrences of the species to the Study Area (NMFS 2015). The Study Area is hydrologically connected to the adjacent Yolo Bypass, and given the proximity to the primary migration corridor for this species, it is anticipated that the Cache Slough Complex is also used by juveniles of the species for passage, rearing, and foraging. Given the location of the Study Area in relation to known occurrences of the species, the distance to the species migration corridor, and the presence of suitable rearing and foraging habitat in sloughs surrounding the Study Area, this species was determined to have high potential to occur seasonally within tidal habitats surrounding the Study Area and may occur within the Vogel portion of the Study Area during flooding.

Longfin smelt (*Spirinchus thaleichthys*). Federal Candidate, State Threatened, CDFW Species of Special Concern. The longfin smelt is an anadromous fish found in California's bay, estuary, and nearshore coastal environments. Its range extends along the Pacific Coast of North America from the Sacramento-San Joaquin Estuary in California, north to the Gulf of Alaska (Moyle 2002). The San Francisco Estuary supports the largest, and southern-most population in California (Moyle 2002). Longfin smelt are known to inhabit the entire San Francisco Estuary, including portions of the Napa River, Suisun Marsh, and the Sacramento-San Joaquin Delta (CDFW 2009). The species is also currently proposed for listing under the federal ESA (USFWS 2013).

Juvenile longfin smelt feed on copepods and cladocerans. With subsequent growth, their diet expands to include mysids and amphipods (CDFW 2009). Longfin smelt are an important prey species and are fed upon by many native and non-native species of predatory fish. However, striped bass (*Morone saxatilis*) are a dominant predator of longfin smelt in the Sacramento-San Joaquin Delta (CDFW 2009). The other primary threats to the species are due to the effects of

water diversions from the Delta (Moyle 2002).

Longfin smelt typically use backwater sloughs and channels like those within the Cache Slough Complex for both feeding and rearing (CDFW 2009). This species has been documented immediately downstream of the Study Area near Liberty Island during CDFW trawl surveys (CDFW 2018c). Focused surveys within the Cache Slough Complex and Yolo Bypass conducted by University of California, Davis has documented this species in Cache, Hass, and Shag Sloughs (Young et al. 2015). Given that the Study Area is surrounded by documented occurrences of this species, and suitable habitat for rearing and foraging is present, the species is considered present within the surrounding tidal sloughs and was determined to have high potential to occur within the waters immediately adjacent to the Study Area and potentially within the Vogel property during periods of flooding.

Nuttall's woodpecker (*Picoides nuttallii*). USFWS Bird of Conservation Concern. Nuttall's woodpecker, common in much of its range, is a year-round resident throughout most of California, west of the Sierra Nevada Mountains. Typical habitat for this species is oak or mixed woodland and riparian areas (Lowther 2000). Nesting occurs in tree cavities, principally those of oaks and larger riparian trees. Nuttall's woodpecker also occurs in older residential settings and on orchards, where trees provide suitable foraging and nesting habitat. This species forages on a variety of arboreal invertebrates.

In this portion of Solano County, this species is fairly common and nesting has been confirmed north of the Study Area (Rippey 2014). During multiple site visits, woodpecker cavities were observed in trees throughout the Study Area. Based on the evidence of previous use of the area by woodpeckers and the documented occurrences nearby, this species was determined to have a high potential to occur in the Study Area.

Steelhead - Central Valley Distinct Population Segment (DPS; *Oncorhynchus mykiss*). **Federal Threatened.** The Central Valley DPS includes all naturally spawned populations (and their progeny) in the Sacramento and San Joaquin Rivers and their tributaries, excluding San Francisco and San Pablo Bays and their tributaries. Preferred spawning habitat for steelhead is in perennial streams with cool to cold water temperatures, high dissolved oxygen levels and fast flowing water. During the winter or early spring, the spawning fish reach suitable gravel riffles (shallow areas with gravel or cobble substrate) in the upper sections of streams, where they dig their redds. Abundant riffle areas for spawning and deeper pools with sufficient riparian cover for rearing are necessary for successful breeding. When steelhead spawn, they nearly always return to the stream in which they were hatched. At that time, they may weigh between 2 to 12 pounds, or more.

The Study Area is located directly adjacent to the primary migration corridor (the Sacramento River and the DWSC) for this species (NMFS 2016a). While adults do not typically use sloughs, marshes, or off-channel habitats like those surrounding the Study Area, juvenile salmonids require such habitat for rearing, and as cover during outmigration (NMFS 2016a). Juvenile steelhead have been regularly encountered by the CDFW within the Yolo Bypass during fish salvage operations following flood events (DWR 2015). The Yolo Bypass is hydrologically connected to the Study Area, therefore it is likely that the Cache Slough complex also serves as rearing habitat for the species. Therefore, due to the presence of habitat within and surrounding the Study Area, the proximity to migration corridors used by the species, and the presence of steelhead in adjacent habitats during salvage operations, this species was determined to have high potential to be seasonally present, particularly during the outmigration period of juvenile fishes.

White-tailed kite (*Elanus leucurus*). CDFW Fully Protected Species. The white-tailed kite is a resident in open to semi-open habitats throughout the lower-elevation areas of California, including grasslands, savannahs, woodlands, agricultural areas, and wetlands. Vegetative structure and prey availability seem to be more important habitat elements for this species than associations with specific plants or vegetative communities. Nests are constructed mostly of twigs and are placed in trees, often at habitat edges. Nest trees are highly variable in size, structure, and immediate surroundings, ranging from shrubs to trees greater than 150 feet tall. This species preys on a variety of small mammals, as well as other vertebrates and invertebrates.

This species has been observed within the local area and frequents agricultural areas where grasses are short and hunting for small mammals is aided by farm activities. While the Study Area has been regularly flood irrigated, open grasslands along levees and areas cleared for residential use are likely to support a prey base of small mammals, such as mice and voles as well as non-flooded annual grasslands. Large trees along levees also have sufficient structure to support nesting by this species. The species has not been observed on-site during multiple surveys despite the presence of potential foraging and nesting habitat; therefore, this species was determined to have only high potential to nest within the Study Area.

Species with Moderate Potential to Occur within the Study Area

Black-crowned night-heron (*Nycticorax nycticorax*). No status; nesting sites (rookeries) monitored by the CDFW. The black-crowned night-heron is a year-round resident in California, and like other herons is associated with aquatic habitats. Nesting occurs colonially (often with other heron or waterbird species). Nesting substrates include trees (many types and sizes), shrubbery, emergent and herbaceous vegetation, and even the ground. This species is generally nocturnal and forages primarily for fish and aquatic invertebrates.

This species has been observed foraging and perching during surveys. In addition, a rookery of egrets and cormorants is located on a series of small islands within Hass Slough outside of the Study Area. Potential rookery habitat was observed within the northern riparian portion of Lookout Slough; however, no nesting was confirmed. Therefore, this species is present, but only considered to have a moderate potential to nest within the Study Area.

Grasshopper sparrow (*Ammodramus savannarum*). CDFW Species of Special Concern. Grasshopper sparrow is a summer resident in California, wintering in Mexico and Central America. This species occurs in open grassland and prairie-like habitats with short- to moderate-statured vegetation, and often in scattered shrubs (Shuford and Gardali 2008). Both perennial and non-native annual grasslands are used. Nests are placed on the ground and are well concealed, often adjacent to grass clumps (Shuford and Gardali 2008). Grasshopper sparrows are evasive and are generally detected by voice. Insects comprise the majority of their diet.

Rippey (2014) recorded nesting by this species in the Maine Prairie near the Study Area. Primary land use within Bowsbey Ranch portions of the Study Area is irrigated pasture, which maintains short-statured, open grassland; however, the grazing regime reduces grass height such that Bowsbey Ranch portion of the Study Area does not support nesting. The non-native annual grassland within Liberty Farms does provide suitable nesting structure for this species and limited areas of the Vogel property may provide suitable nesting habitat. Based on occurrences in the vicinity, this species was determined to have moderate potential to nest within the non-native annual grassland areas of the Study Area although it may be observed foraging on occasion in other portions of the Study Area.

Greater sandhill crane (*Grus canadensis tabida*). State Threatened, CDFW Fully Protected Species. This species breeds only in Siskiyou, Modoc Lassen, Plumas, and Sierra Counties (USFWS, City of Sacramento, and Sutter County 2002). In summer, this species occurs in and near wet meadows, shallow lacustrine, and fresh emergent wetland habitats. It winters primarily in the Sacramento and San Joaquin valleys, where it frequents annual and perennial grassland habitats, moist croplands with rice or corn stubble, and open, emergent wetlands. It prefers relatively treeless plains.

The Study Area is comprised of irrigated pastures, which may provide winter foraging habitat when cranes seasonally migrate to the region. Greater sandhill crane do not breed or nest in the Delta or the Central Valley, any occurrence of the species is anticipated to be associated with wintering/non-breeding activity. This species has not been documented onsite, and records of this species in the areas surrounding the Study Area are very sparse (Sullivan et al 2018). The Study Area is also not within or near any known roosting grounds. This same database shows exponentially more observations further east. Within and near to the Study Area, observations are very limited. Additionally, roosting by this species typically relies on flooded agricultural fields or flooded wetlands. Hunting has been shown to cause disturbance to cranes and is generally incompatible with crane roosting or foraging (Ivey et al 2014). Liberty Farms has supported duck hunting for many years and is likely to also limit use of the Study Area by cranes. Therefore, while the Study Area contains irrigated pasture and managed wetlands, it is unlikely that the Study Area would support or attract roosting or foraging cranes. However, this species seasonally migrates through the area and despite disturbances, the species may still land for brief foraging events in the Study Area as no barriers are present to prevent the species from stopping during migration. Because of the potential presence of cranes during wintering periods, this species was determined to have a moderate potential to occur as a winter migrant.

Least bittern (*Ixobrychus exilis*). CDFW Species of Special Concern, USFWS Bird of Conservation Concern. California populations of least bittern are concentrated in low-lying areas of the Central Valley and Modoc Plateau, along the Colorado River, and coastal southern California, south of San Luis Obispo County. Colonial nesters are found in fresh and brackish marshlands and along margins of ponds and reservoirs which provide ample cover. Nests are usually placed low in hardstem bulrush, over water, and are constructed from emergent aquatic vegetation and sticks (Poole et al. 2009).

Marshes around the southern edge of Liberty Farms within the Study Area have been historically maintained as duck ponds for hunting. Such habitats are also likely to provide suitable nesting and foraging habitat for this species. This species has been observed in the vicinity of the Study Area (Sullivan et al. 2018), but recent surveys have not documented nesting within Solano County (Rippey 2014). Due to the presence of potentially suitable habitat and observations of least bittern in the vicinity of the Study Area, this species was determined to have moderate potential to nest within the Study Area.

Lesser sandhill crane (*Grus canadensis canadensis*). CDFW Species of Special Concern. The lesser sandhill crane is a California species of special concern. This subspecies breeds in Alaska but winters in California within the Central and Imperial Valleys. In winter, grains and seeds are the dominant food source for lesser sandhill crane (Shuford and Gardali 2008). Pastures, moist grasslands, and shallow wetlands or flooded fields are used for loafing and roosting.

The Study Area is comprised of irrigated pastures, which may provide winter foraging habitat when cranes seasonally migrate to the region. Lesser sandhill crane do not breed or nest in the

Delta or the Central Valley, any occurrence of the species is anticipated to be associated with wintering/non-breeding activity. This species has not been documented onsite, and records of this species in the areas surrounding the Study Area are very sparse (Sullivan et al 2018). The Study Area is also not within or near any known roosting grounds. This same database shows exponentially more observations further east. Within and near to the Study Area, observations are very limited or absent entirely. Additionally, roosting by this species typically relies on flooded agricultural fields or flooded wetlands. Hunting has been shown to cause disturbance to cranes and is generally incompatible with crane roosting or foraging (Ivey et al 2014). Liberty Farms has supported duck hunting for many years and is likely to also limit use of the Study Area by cranes. Therefore, while the Study Area contains irrigated pasture and managed wetlands, it is unlikely that the Study Area would support or attract roosting or foraging cranes. However, this species seasonally migrates through the area and despite disturbances, the species may still briefly forage on occasion in the Study Area as no barriers are present to prevent the species from stopping during migration. Because of the potential presence of cranes during wintering periods, this species was determined to have a moderate potential to occur as a winter migrant.

Pallid bat (*Antrozous pallidus*). CDFW Species of Special Concern, WBWG High Priority. Pallid bats are distributed from southern British Columbia and Montana to central Mexico, and east to Texas, Oklahoma, and Kansas. This species occurs in a number of habitats ranging from rocky, arid deserts to grasslands, and into higher-elevation coniferous forests. They are most abundant in the arid Sonoran life zones below 6,000 feet, but have been found up to 10,000 feet in the Sierra Nevada Mountains. Pallid bats often roost in colonies of between 20 and several hundred individuals. Roosts are typically located in rock crevices, tree hollows, mines, caves, and a variety of man-made structures, including vacant and occupied buildings. Tree roosting has been documented in large conifer snags (e.g., ponderosa pine), inside basal hollows of redwoods and giant sequoias, and within bole cavities in oak trees. They have also been reported roosting in stacks of burlap sacks and stone piles. Pallid bats are primarily insectivorous, feeding on large prey that is usually taken on the ground but sometimes in flight. Prey items include arthropods, such as scorpions, ground crickets, and cicadas (WBWG 2018).

Typically, this species has been found in attics, crawl spaces of buildings, barns or even rock piles which offer thermal refugia while still having close access to water and foraging opportunities such as marshes. The Study Area contains some farm buildings (e.g. barns) as well as other structures that may support roosting while nearby freshwater marshes can support drinking and foraging needs by the species. Because of the presence of potential roosting structures and the proximity of water and foraging locations this species was determined to have moderate potential to occur.

Tricolored blackbird (*Agelaius tricolor*). State Threatened, CDFW Species of Special Concern, USFWS Bird of Conservation Concern. The tricolored blackbird is a locally common resident in the Central Valley and along coastal California. Most tricolored blackbirds reside in the Central Valley March through August, then move into the Sacramento-San Joaquin Delta, and east to Merced County and coastal locations during winter (Meese et al. 2014). This species breeds adjacent to freshwater, preferring emergent wetlands with tall, dense cattails or tules, thickets of willow or blackberry, and/or tall herbs. Flooded agricultural fields with dense vegetation are also used (Shuford and Gardali 2008). This species is highly colonial; nesting habitat must be large enough to support a minimum of 30 pairs, and colonies are commonly substantially larger (up to thousands of pairs). The tricolored blackbird often intermingles with other blackbird species during the non-breeding season. Individuals typically forage up to 5.6 miles (9 kilometers) from their colonies; although, in most cases only a small part of the area within this range provides suitable foraging (Hamilton and Meese 2006).

There are records of the tricolor blackbirds within 5 miles of the Study Area, and likely breeding colonies within 10 miles (CDFW 2018a). Although the majority of the Study Area does not provide suitable habitat for the species, freshwater marshes with dense emergent vegetation on the margins of the Study Area, especially in the south, could potentially support habitat for a breeding colony, while current maintenance of the majority of the Liberty Farms area as managed wetlands could be limiting food availability during the nesting season.

Yellow warbler (*Setophaga (Dendroica) petechia brewsteri*). **CDFW Species of Special Concern, USFWS Bird of Conservation Concern.** The yellow warbler is a neotropical migrant bird that is widespread in North America, but it has declined throughout much of its California breeding range. The Brewster's (*brewsteri*) subspecies is a summer resident and represents the vast majority of yellow warblers that breed in California. West of the Central Valley, typical yellow warbler breeding habitat consists of dense riparian vegetation along watercourses, including wet meadows, with willow growth being favored (Shuford and Gardali 2008). Insects comprise the majority of this species' diet.

Willow riparian areas lining the banks of Lookout Slough and windrows within Liberty Farms provide potential nesting habitat for this species. Potential foraging habitat is also supported throughout the riparian along perimeter levees as well. Given that potential foraging and nesting habitat are present and this species has been observed in Liberty Island near the Study Area, but the species has not been observed on-site during multiple surveys and is uncommon in the region, this species only was determined to have moderate potential to nest within the Study Area.

White sturgeon (*Acipenser transmontanus*). **CDFW Species of Special Concern.** This sturgeon is found in most estuaries along the Pacific Coast, and is known to the San Francisco Bay Estuary. Adults in the San Francisco Bay Estuary system spawn in the Sacramento River and are not known to enter freshwater or non-tidal reaches of estuary streams. White sturgeon typically spawn in May through June. Their diet consists of crustaceans, mollusks, and some fish.

White sturgeon are known to use the Sacramento DWSC to migrate from spawning grounds in the Sacramento and Feather Rivers out to the San Francisco Bay (Calfish 2018). During these migrations, or during general foraging, individuals are anticipated to occur within sloughs surrounding the Study Area. Considering the known distributions of the species, and the location of the Study Area, the species was determined to have moderate potential to be present in waters surrounding the Study Area throughout the year.

Species which have been documented in the vicinity but have been found Unlikely, or have No Potential to occur are discussed more fully below.

California black rail (*Laterallus jamaicensis coturniculus*), State Threatened, CDFW Fully Protected Species, USFWS Bird of Conservation Concern. The California black rail is the resident black rail subspecies that occurs in California coastal salt and brackish marshes from Bodega Bay to Morro Bay, with additional populations known from freshwater marshes near or in the northern Sierra Nevada foothills (Eddleman et al. 1994, Richmond et al. 2008). According to a published analysis by Spautz et al. (2005), important habitat elements for this species within the San Francisco Bay estuary are: 1) emergent marsh dominated by pickleweed (name), marsh gumplant (*Grindelia stricta*), bulrush (*Scirpus maritimus*), rushes (*Juncus* spp.), and/or cattails (*Typha* spp.); 2) high density of vegetation below four inches in height; 3) high marsh elevation with transitional upland vegetation; 4) large total area of contiguous marsh; 5) proximity to a major water source; and, 6) isolation from disturbance. This species feeds primarily on invertebrates. Black rails are extremely secretive and very difficult to glimpse or flush; identification typically relies on voice. Nests are placed on the ground in dense wetland vegetation.

As outlined by Tsao et al. (2015), CBR has been recently documented in portions of the Sacramento-San Joaquin Delta, particularly on densely vegetated in-channel islands. The only portions of the Study Area modeled as potentially suitable by Tsao et al. (2015) were within the Vogel Property. This area, along with the southern portions of Liberty Farms were investigated further for potential to support CBR as part of reconnaissance level surveys and baseline studies. WRA performed a CBR call play back reconnaissance survey covering these areas as described in section 3.2.4, including the areas modeled by Tsao et al. (2015). The assessment did not detect any rails, and the habitat assessment determined the vegetative quality for rails is low due to the composition of non-native species, height or density of vegetation and regular disturbance associated with duck hunting and land management specific to duck hunting. Given the location of the Study Area outside of the margins of CBR's known local range (Sullivan et al. 2018), the relative low quality of the habitats present, and the negative survey results, and lack of suitable quality habitat, CBR is assessed as unlikely to occur within the Study Area.

Least Bell's vireo (*Vireo bellii pusillus*), Federal Endangered, State Endangered, CDFW Species of Special Concern. This subspecies of Bell's vireo is a neotropical migrant and summer resident in California and northern Baja California, wintering in southern Baja California (Brown 1993). This vireo was once common in lowland riparian habitats throughout California but declined precipitously during the twentieth century (USFWS 1998). By the time of federal listing in 1986, an estimated 300 pairs were restricted to southern California, primarily San Diego County (USFWS 1998). The population has increased since, with the number of nesting territories in the state in 2006 estimated to be approximately ten times greater than in 1986 (USFWS 2006). However, the distribution of the vireo at that time remained almost entirely within southern California (USFWS 2006).

Least Bell's vireo breeding habitat consists of riparian vegetation, usually in an early successional state (i.e., between five and ten years old), and near water (USFWS 1998). Such habitat is preferred because it provides both dense cover in the lower shrub layer for nest concealment, and a stratified canopy structure favorable to insect abundance and thus vireo foraging (USFWS 1998). Riparian habitat types used for breeding include those dominated by willows, cottonwood, and/or oaks, with a dense understory of species such as willows, mulefat, California wild rose, poison oak, and mugwort (USFWS 1998). Nests are typically placed within three feet of the ground. Least Bell's Vireo may attempt multiple broods during the breeding season from mid-March to late September, although one brood is typical (Brown 1993). Habitats such as chaparral and coastal sage scrub adjacent to riparian areas are used for foraging and even nesting, and thus provide another potentially important habitat component (Kus and Miner 1989). Along with habitat destruction, brood parasitism by the brown-headed cowbird (*Molothrus ater*) is widely considered a major contributor to the decline of least Bell's vireo, and a continuing challenge to its recovery.

There are no official records of least Bell's vireo within five miles of the Action Area (CDFW 2018a). There are unofficial eBird records of the species at Bradford Island within the last year, but this area is over 13 miles from the Action Area, and the only other records within the last two years are 60 miles from the Action Area (Sullivan et al 2018). Notes on these observations do not indicate breeding pairs. Prior to the mid 1900's the species was common throughout the interior of California, but by the 1970's they were largely extirpated following extensive habitat loss and brood parasitism (USFWS 1998). As of 2006, the species had not recolonized historic breeding ranges in the Central Valley and remains largely constricted to Southern California (USFWS 2006). Though there is the potential for least Bell's vireo to occur within the Study Area, this is expected to occur very rarely and only in passing, if at all during the timeframe for construction.

Mountain plover (*Charadrius montanus*), CDFW Species of Special Concern, USFWS Bird of Conservation Concern. The mountain plover is a winter visitor to California, occurring primarily in the Central Valley and scattered portions of the southern California interior lowlands. It requires shortgrass prairie habitats or their equivalents, which in contemporary California typically consist of agricultural fields with sprouting crops or bare dirt (Shuford and Gardali 2008). This species forages primarily upon insects.

Historically, this species wintered further south on dry plains near Los Angeles (Knopf and Wunder 2006). This species spends a majority of its time within its winter range on arid, heavily grazed, or even bare ground. Tilled or bare agricultural fields may also be used (Knopf and Wunder 2006). The Study Area contains irrigated pasture or emergent marsh, both of which are unsuitable for the species due to the hydrologic conditions typically present. Though the species occurs in the vicinity of the Study Area in winter, it is unlikely to be present due to the lack of suitable dry grassland habitat.

Valley Elderberry Longhorn Beetle (*Desmocerus californicus dimorphus*), Federal Threatened Species. The valley elderberry longhorn beetle (VELB) is completely dependent on its host plant, elderberry (*Sambucus sp.*). This species is commonly found within remnant sections of riparian forests and adjacent upland habitats within the Central Valley portion of California. Use of the host plant is often only discernable by exit holes created by larva just prior to the pupal stage. The life cycle of VELB takes one or two years to complete (USFWS 1984). The animal spends most of its life in the larval stage, living within the stems of elderberry shrubs. Adult emergence typically occurs in late March through June, or approximately during the flowering season for elderberry. The adult life stage is then fairly short lived before reproducing and depositing eggs within the stems of the shrub (USFWS 1999).

There are no records of valley elderberry longhorn beetle within five miles of the Study Area. Focused surveys for valley elderberry longhorn beetle and the species host plant were conducted in the Study Area by WRA biologists on August 27 and September 7, 2018, and were supplemented with additional rare plant surveys. Surveys followed the USFWS (2017) Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle, which included the preliminary surveys to identify elderberry host plants within the Study Area, a survey of all habitat and elderberry plants within 50 meters (165 feet) of host plants found within the Study Area, and an examination of elderberry stems for exit holes and presence of the beetle. Elderberry host plants were photographed and their locations were recorded.

Lands within the Study Area have been used for flood irrigated pasture and winter waterfowl management collectively for several decades. Land management, grazing practices, and levee maintenance result in frequent disturbance and alteration of vegetation within the Study Area, and only one small, isolated group of five elderberry shrubs and two saplings were found on the outboard of the Shag Slough Levee. The patch was located in an area containing riprap, is subject to flooding, and devoid of a dominant riparian canopy vegetation. No exit holes of any type were observed in the elderberry shrubs, and no valley elderberry longhorn beetles were observed.

Based on the minimal number of host shrubs present, absence of exit holes on the shrubs, and isolation of the Study Area from documented occurrences, it is unlikely that the valley elderberry longhorn beetles would occur in the Study Area. In addition, there are no nearby documented populations from which beetles might immigrate and establish within the Study Area.

4.2.3 Critical Habitat

A review of the background literature showed that the Study Area is located within or adjacent to critical habitat for four special-status fish species including:

- Delta smelt
- Central Valley Spring-run Chinook salmon
- Central Valley steelhead
- Southern DPS green sturgeon

Figure 8 in Appendix A shows the locations of those units of critical habitat in relation to the Study Area. Currently, flood control levees exclude the majority of the Study Area from providing biological or physical components of these species' critical habitat. The exception would be the exterior (outer) levee and Vogel portion of the Study Area, which afford some habitat to each species during flood events.

4.2.4 Essential Fish Habitat

A review of the background literature revealed that the Study Area is located within or adjacent to EFH for two fisheries management plans (FMP): Pacific Groundfish and Pacific Salmon. The waters of Cache, Hass, and Shag Sloughs are identified as EFH for Pacific Groundfish, while the entire watershed encompassing the Study Area is located within the Lower Sacramento unit of EFH for Pacific Salmonids. Similar to critical habitat discussed in Section 4.2.3, the majority of the Study Area is isolated from waters and habitat that form EFH due to flood control levees; the exception being the exterior (outer levee area and Vogel during flood event). A brief description of species covered by each fisheries management plan is outlined below.

Pacific Groundfish EFH: The Pacific Groundfish FMP is designed to protect habitat for approximately 80 species of fish, including various species of flatfish, rockfish, roundfish, and several species of sharks and skates.

Pacific Salmon EFH: The Pacific Salmon FMP is designed to protect habitat for commercially important salmonid species. Chinook salmon is the primary species that would be seasonally present within waters surrounding the Study Area.

5.0 SUMMARY

Five sensitive plant communities were identified within the Study Area. Four special-status plant species and 23 special-status wildlife species are present or have a moderate or high potential to occur within the Study Area.

5.1 Biological Communities

The Study Area contains sensitive biological communities including approximately 35.58 acres of Great Valley mixed riparian forest, 1,127.13 acres of coastal and valley freshwater marsh, and 329.64 acres of open waters associated with drainage ditches, irrigation ponds, and both tidal and non-tidal sloughs.

5.2 Special-Status Plant Species

Within the Study Area, four special-status species were determined to be present during protocol-level special-status plant surveys, including Parry's rough tarplant, woolly rose-mallow, Mason's lilaeopsis, and Suisun Marsh aster.

5.3 Special-Status Wildlife Species

Within the Study Area, the following species that were observed and determined to be present: giant garter snake, loggerhead shrike, northern harrier, Sacramento splittail, song sparrow - Modesto population, Swainson's hawk, and western pond turtle. Nine special-status wildlife species were determined to have high potential of occurrence including; chinook salmon - Central Valley fall/late fall-run, Central Valley spring-run, and Sacramento River winter-run ESUs, Delta smelt, green sturgeon - Southern DPS, longfin smelt, Nuttall's woodpecker, steelhead - Central Valley DPS, and white-tailed kite. Additionally, the following nine species have moderate potential to occur within the Study Area: black-crowned night-heron, grasshopper sparrow, greater sandhill crane, least bittern, lesser sandhill crane, pallid bat, tricolored blackbird, yellow warbler, and white sturgeon.

Designated critical habitat for four species occurs within the Study Area, including Delta smelt, Central Valley Spring-run Chinook salmon, Central Valley steelhead, and Southern DPS green sturgeon. Furthermore, the Study Area contains EFH for species covered by the Pacific Groundfish and Pacific Salmon FMPs.

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APPENDIX A
FIGURES

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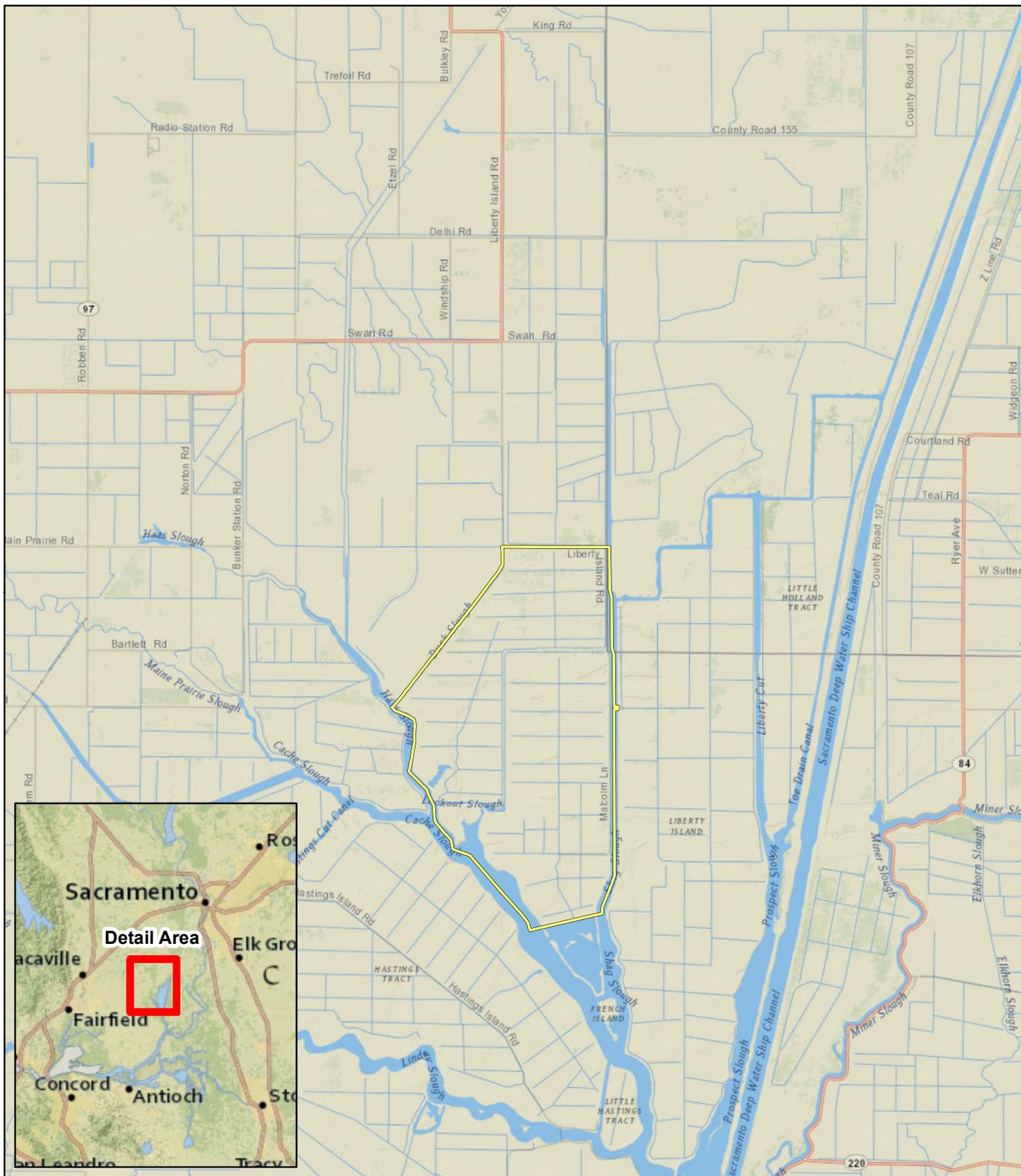
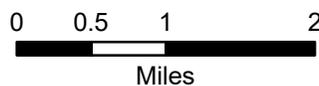


Figure 1. Study Area Location

Lookout Slough Tidal Habitat Restoration
and Flood Improvement Project
Solano County, California



**Ecosystem
Investment
Partners**

Prepared by:



Map Prepared Date: 12/14/2018
Map Prepared By: pkobylarz
Base Source: Esri - Nat. Geo.
Data Source(s):

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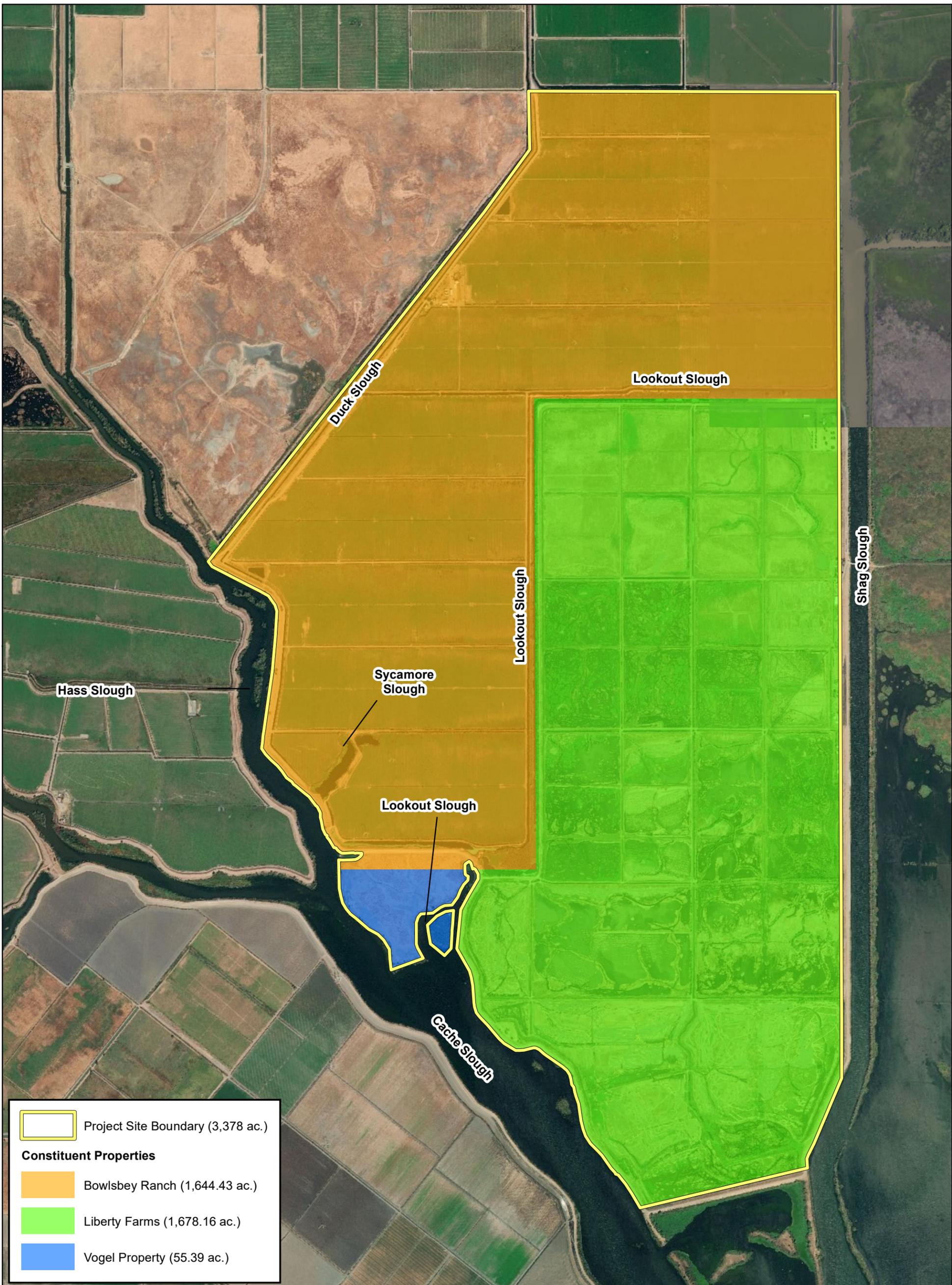
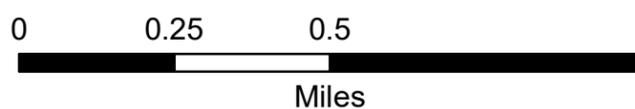


Figure 2. Property Boundaries

Lookout Slough Tidal Habitat Restoration and Flood Improvement Project
Solano County, California



Ecosystem Investment Partners

Prepared by:

Map Prepared Date: 8/21/2019
Map Prepared By: njander
Base Source: Wood Rogers
Base Date: 10/24/17
Data Source(s): WRA



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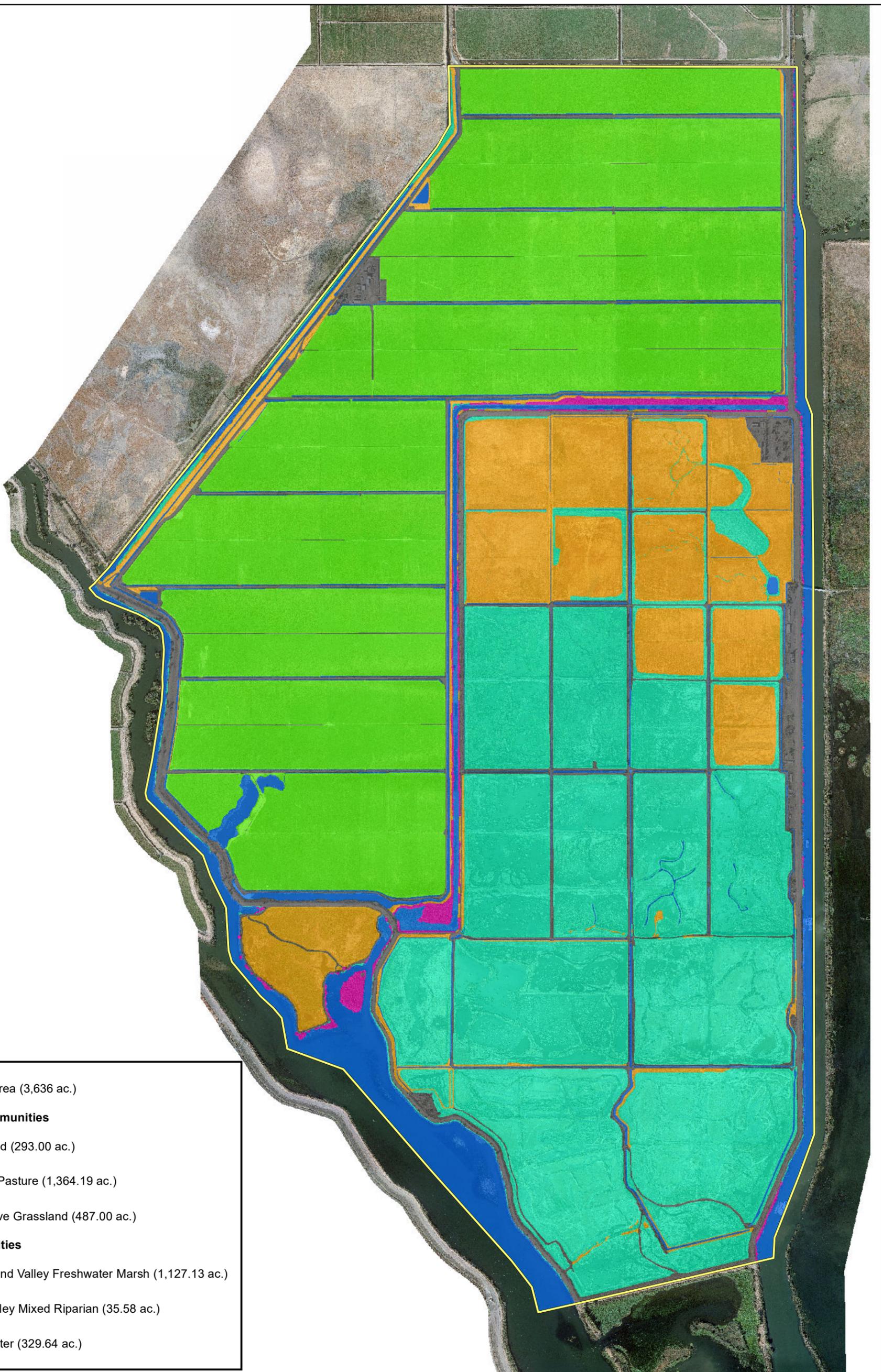
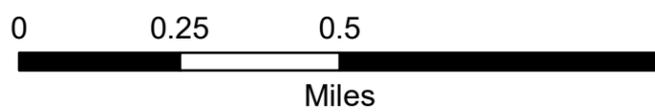


Figure 3. Biological Communities within the Study Area

Lookout Slough Tidal Habitat Restoration and Flood Improvement Project
Solano County, California

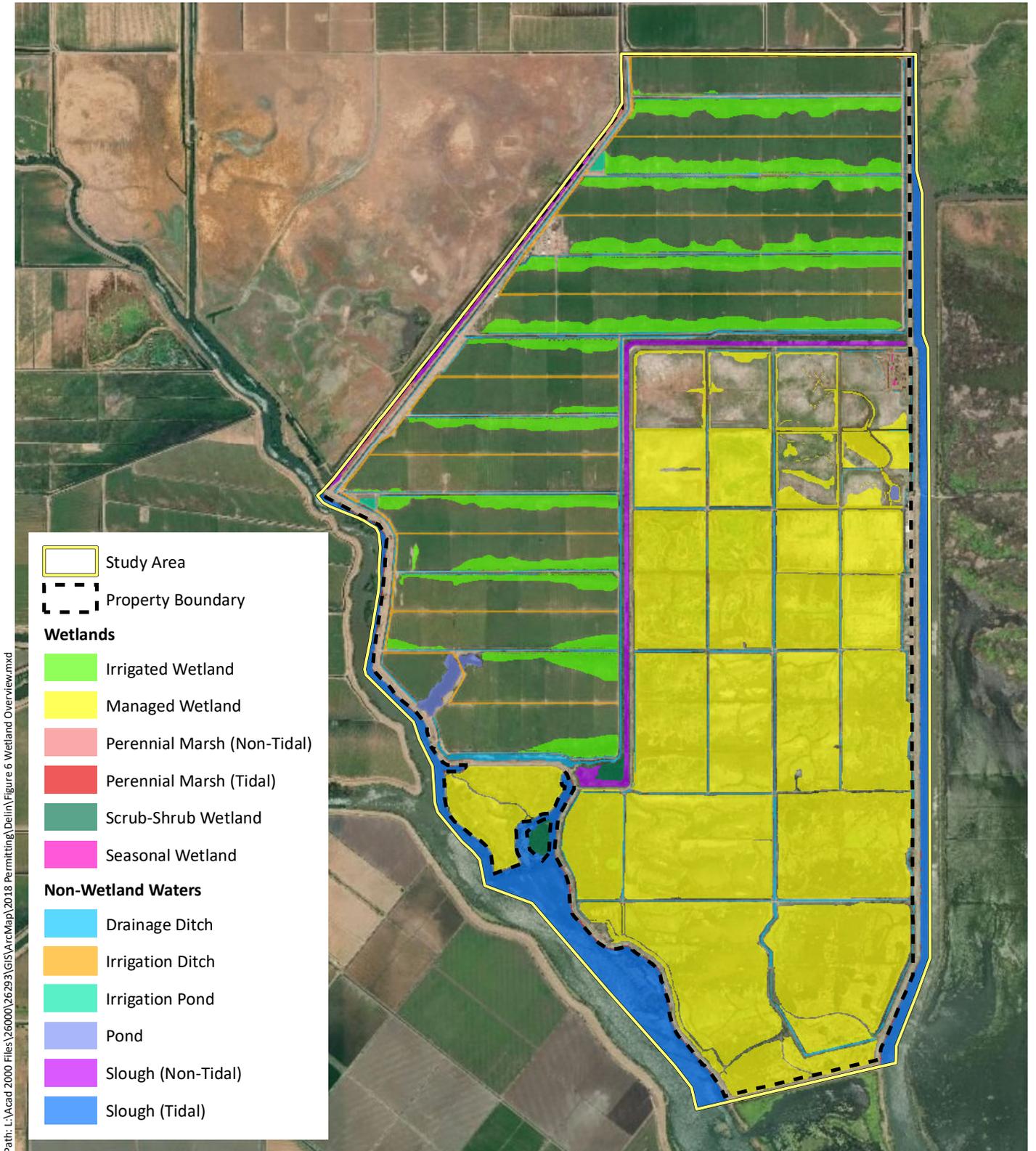


Prepared by:



Map Prepared Date: 10/25/2019
Map Prepared By: pkobylarz
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Base Date: 10/24/17
Data Source(s): WRA

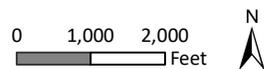
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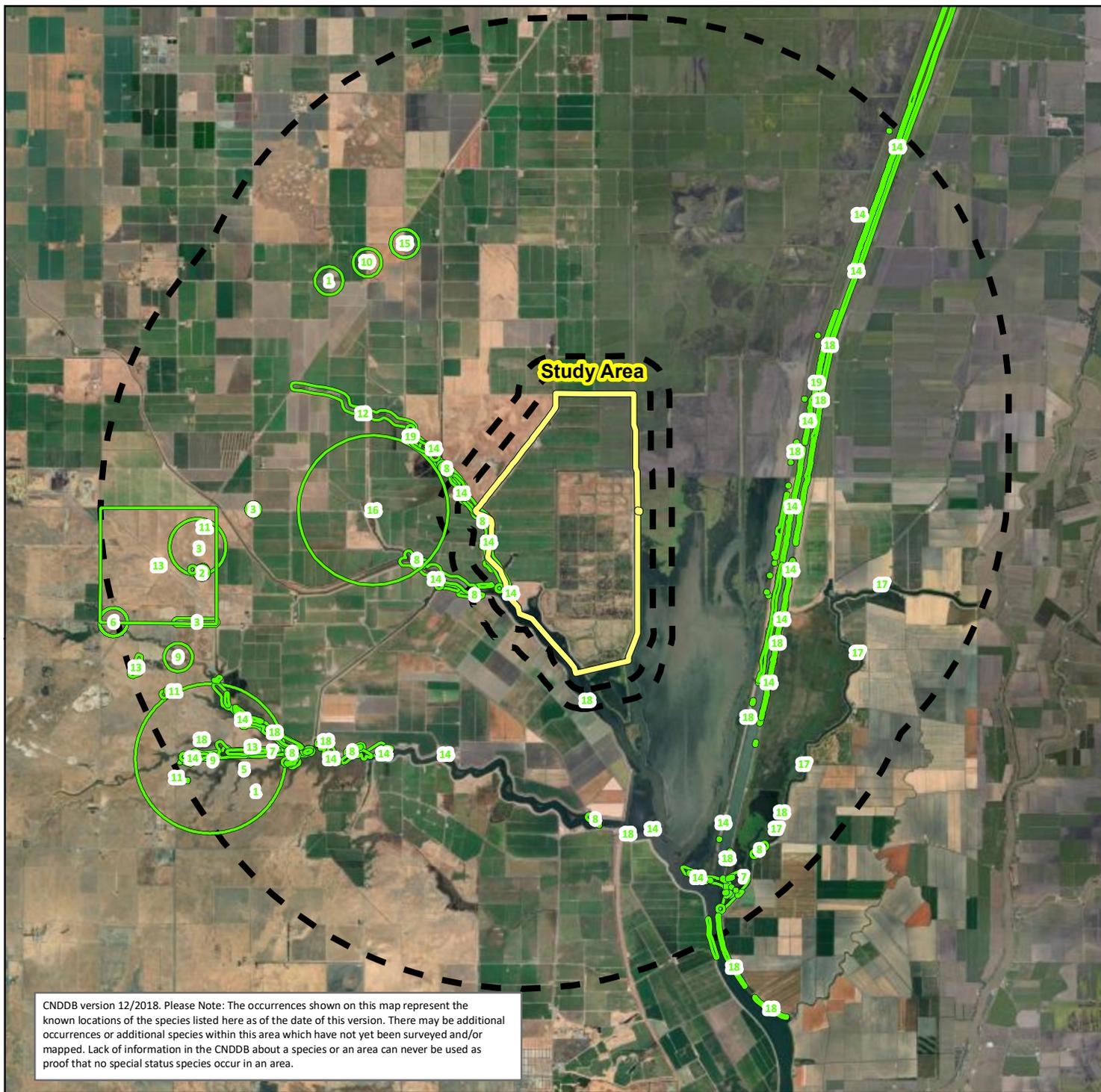
Sources: 2016 DigitalGlobe Aerial, WRA | Prepared By: pkobylarz, 9/14/2018

Figure 4. Overview of Aquatic Resources within the Study Area

Lookout Slough Tidal Habitat Restoration and Flood Improvement Project
Solano County, California



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CNDDDB version 12/2018. Please Note: The occurrences shown on this map represent the known locations of the species listed here as of the date of this version. There may be additional occurrences or additional species within this area which have not yet been surveyed and/or mapped. Lack of information in the CNDDDB about a species or an area can never be used as proof that no special status species occur in an area.

1, alkali milk-vetch	6, California alkali grass	11, heartscale	16, San Joaquin spearscale
2, Baker's navarretia	7, Delta mudwort	12, Heckard's pepper-grass	17, Sanford's arrowhead
3, bearded popcornflower	8, Delta tule pea	13, legenere	18, Suisun Marsh aster
4, Boggs Lake hedge-hyssop	9, dwarf downingia	14, Mason's lilaeopsis	19, woolly rose-mallow
5, Bolander's water-hemlock	10, Ferris' milk-vetch	15, saline clover	

Figure 5. Special-Status Plant Species Documented within 5 miles of the Study Area

Lookout Slough Tidal Habitat Restoration and Flood Improvement Project
Solano County, California



0 0.5 1
Miles



Ecosystem Investment Partners

Prepared by:



Map Prepared Date: 12/6/2019
Map Prepared By: njander
Base Source: Esri - Dig, Globe
Data Source(s): WRA, USDA

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Figure 6. Special-Status Plants Observed within the Study Area

Lookout Slough Tidal Habitat Restoration and
Flood Improvement Project
Solano County, California



Prepared by:

Map Prepared Date: 12/28/2018
Map Prepared By: pkobylarz
Base Source: Wood Rogers
Base Date: 10/24/17
Data Source(s): WRA



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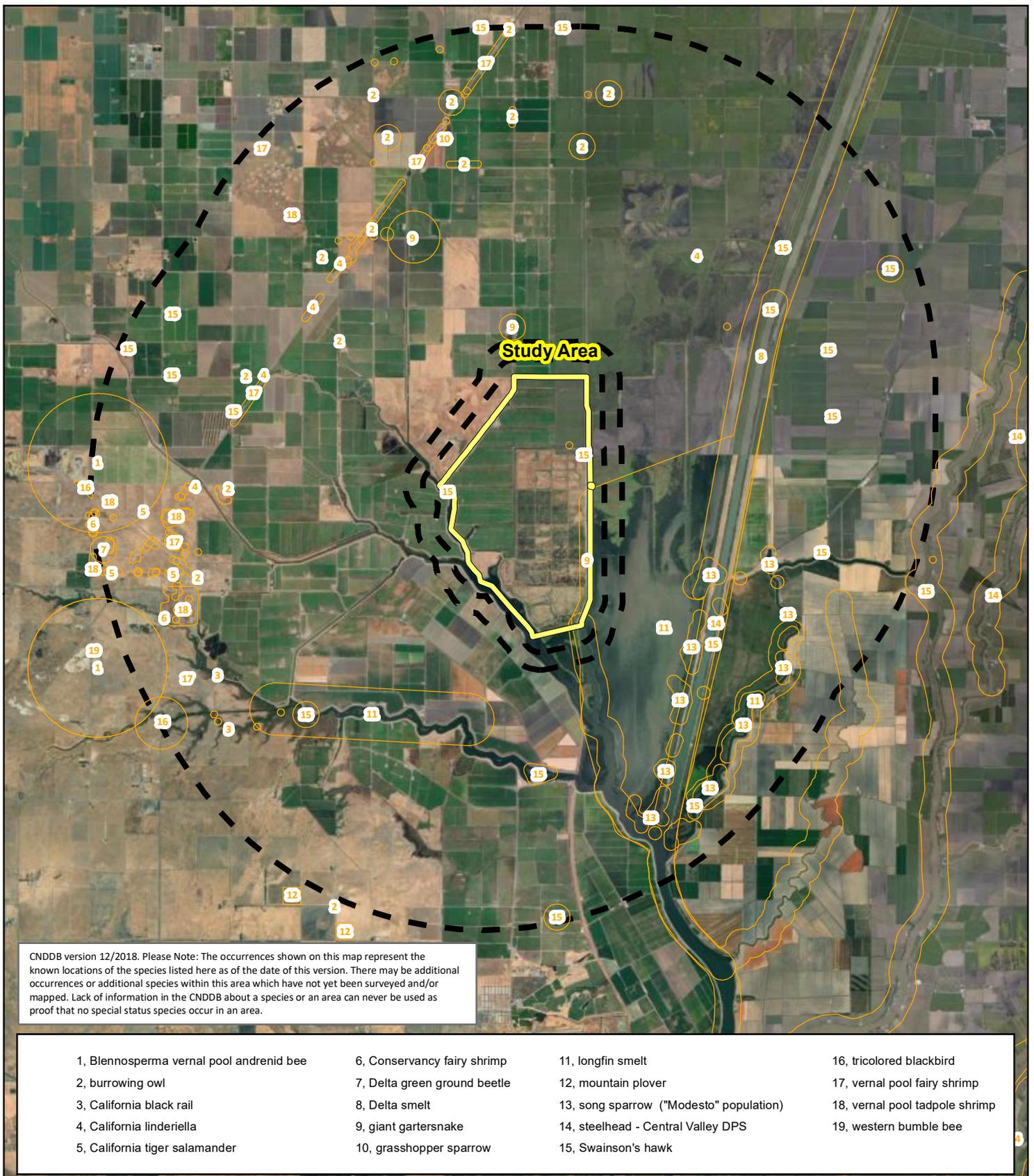


Figure 7. Special-Status Wildlife Species Documented within 5 miles of the Study Area

Lookout Slough Tidal Habitat Restoration and Flood Improvement Project
Solano County, California



0 0.5 1
Miles



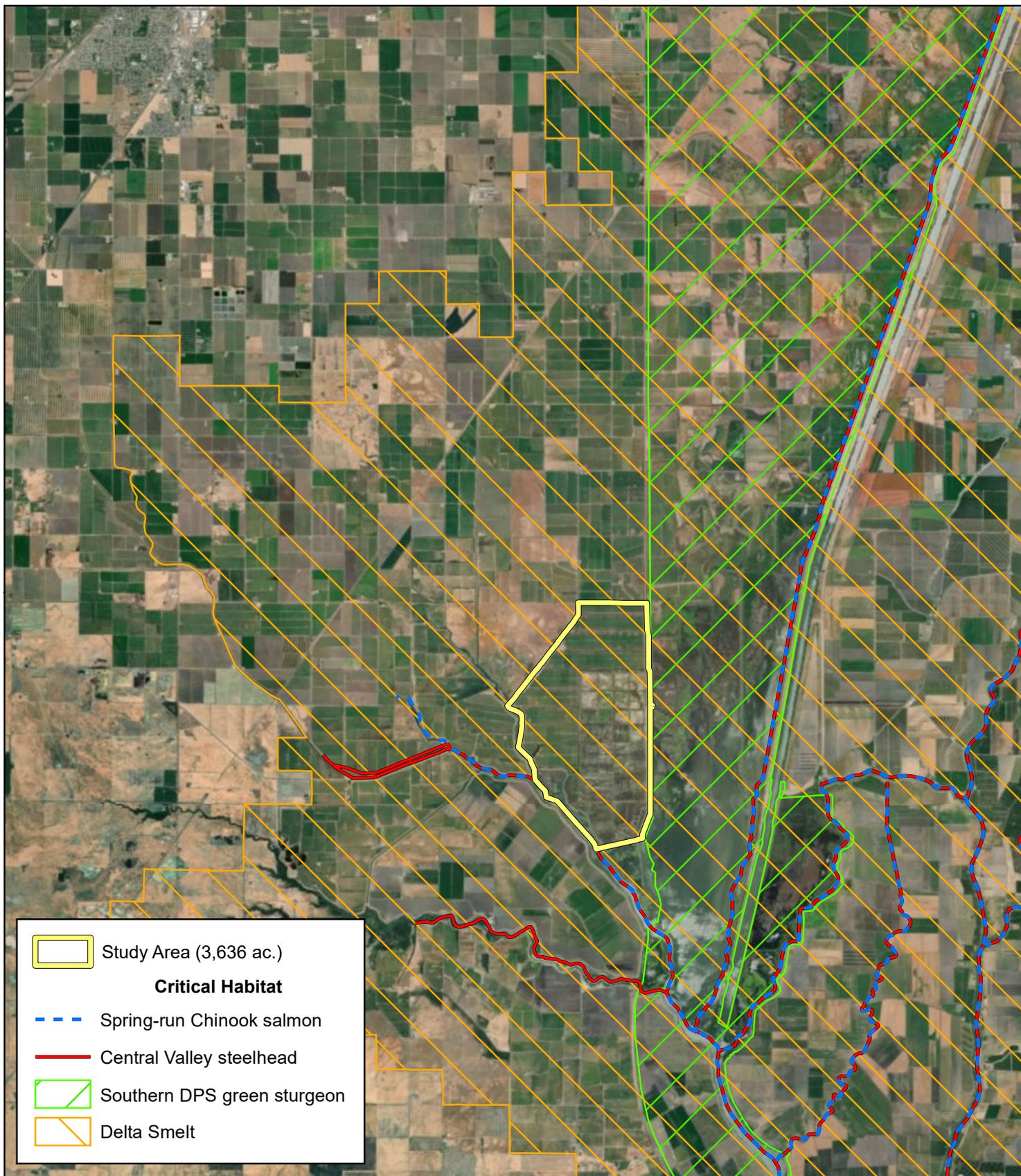
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Map Prepared Date: 12/6/2019
Map Prepared By: nlander
Base Source: Esri - Dig, Globe
Data Source(s): WRA, USDA

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	Study Area (3,636 ac.)
Critical Habitat	
	Spring-run Chinook salmon
	Central Valley steelhead
	Southern DPS green sturgeon
	Delta Smelt

Figure 8. Critical Habitat Within and Adjacent to the Study Area

Lookout Slough Tidal Habitat Restoration and Flood Improvement Project
Solano County, California



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Prepared by:

Map Prepared Date: 12/28/2018
Map Prepared By: pkobylarz
Base Source: Esri - Dig. Globe
Data Source(s): WRA



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APPENDIX B

LIST OF OBSERVED PLANT AND WILDLIFE SPECIES WITHIN THE STUDY AREA

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Appendix B. List of Observed Plant and Wildlife Species within the Study Area

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
Plants							
<i>Abutilon theophrasti</i>	Velvet leaf	non-native	annual herb	-	-	UPL	-
<i>Agrostis</i> sp.	Bentgrass	-	-	-	-	-	-
<i>Alnus rhombifolia</i>	White alder	native	tree	-	-	FACW	-
<i>Amaranthus albus</i>	Tumbleweed	non-native	annual herb	-	-	FACU	gen
<i>Amaranthus californicus</i>	California amaranth	native	annual herb	-	-	FACW	-
<i>Anthemis cotula</i>	Dog fennel	non-native	annual herb	-	-	FACU	-
<i>Artemisia douglasiana</i>	California mugwort	native	perennial herb	-	-	FAC	-
<i>Arundo donax</i>	Giant reed	non-native (invasive)	perennial grass	-	High	FACW	-
<i>Asclepias fascicularis</i>	Milkweed	native	perennial herb	-	-	FAC	gen
<i>Asparagus officinalis</i> ssp. <i>officinalis</i>	Asparagus	non-native	perennial herb	-	-	FACU	-
<i>Atriplex prostrata</i>	Fat-hen	non-native	annual herb	-	-	FACW	-
<i>Atriplex semibaccata</i>	Australian saltbush	non-native (invasive)	perennial herb	-	Moderate	FAC	-
<i>Avena barbata</i>	Slim oat	non-native (invasive)	annual, perennial grass	-	Moderate	-	-

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Azolla filiculoides</i>	Mosquito fern	native	fern	-	-	OBL	-
<i>Baccharis glutinosa</i>	Salt marsh baccharis	native	perennial herb	-	-	FACW	-
<i>Baccharis pilularis</i>	Coyote brush	native	shrub	-	-	-	-
<i>Bidens frondosa</i>	Sticktight	native	annual herb	-	-	FACW	-
<i>Bolboschoenus maritimus</i> ssp. <i>paludosus</i>	Saltmarsh bulrush	native	perennial grasslike herb	-	-	OBL	-
<i>Brassica nigra</i>	Black mustard	non-native (invasive)	annual herb	-	Moderate	-	-
<i>Bromus diandrus</i>	Ripgut brome	non-native (invasive)	annual grass	-	Moderate	-	-
<i>Bromus hordeaceus</i>	Soft chess	non-native (invasive)	annual grass	-	Limited	FACU	gen
<i>Callitriche</i> sp.	-	-	-	-	-	-	-
<i>Carduus pycnocephalus</i> ssp. <i>pycnocephalus</i>	Italian thistle	non-native (invasive)	annual herb	-	Moderate	-	-
<i>Carex barbarae</i>	Valley sedge	native	perennial grasslike herb	-	-	FAC	-
<i>Centaurea calcitrapa</i>	Purple star thistle	non-native (invasive)	annual, perennial herb	-	Moderate	-	-
<i>Centaurea solstitialis</i>	Yellow starthistle	non-native (invasive)	annual herb	-	High	-	gen

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Centromadia parryi</i> ssp. <i>rudis</i>	Pappose tarweed	native	annual herb	Rank 4.2	-	FACW	-
<i>Cephalanthus occidentalis</i>	Common buttonbush	native	shrub	-	-	OBL	-
<i>Ceratophyllum demersum</i>	Hornwort	native	perennial herb	-	-	OBL	-
<i>Chenopodium album</i>	Lambs quarters	non-native	annual herb	-	-	FACU	-
<i>Cirsium vulgare</i>	Bullthistle	non-native (invasive)	perennial herb	-	Moderate	FACU	-
<i>Conium maculatum</i>	Poison hemlock	non-native (invasive)	perennial herb	-	Moderate	FACW	-
<i>Convolvulus arvensis</i>	Field bindweed	non-native	perennial herb, vine	-	-	-	gen
<i>Cotula coronopifolia</i>	Brass buttons	non-native (invasive)	perennial herb	-	Limited	OBL	gen
<i>Cressa truxillensis</i>	Alkali weed	native	perennial herb	-	-	FACW	vpa
<i>Crypsis schoenoides</i>	Swamp grass	non-native	annual grass	-	-	FACW	vpa
<i>Crypsis vaginiflora</i>	African prickly grass	non-native	annual grass	-	-	OBL	vpa
<i>Cuscuta</i> sp.	-	-	-	-	-	-	-
<i>Cynodon dactylon</i>	Bermuda grass	non-native (invasive)	perennial grass	-	Moderate	FACU	-

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Cyperus eragrostis</i>	Tall cyperus	native	perennial grasslike herb	-	-	FACW	gen
<i>Daucus carota</i>	Carrot	non-native	perennial herb	-	-	UPL	-
<i>Daucus pusillus</i>	Wild carrot	native	annual herb	-	-	-	-
<i>Digitaria sanguinalis</i>	Crabgrass	non-native	annual grass	-	-	FACU	-
<i>Distichlis spicata</i>	Salt grass	native	perennial grass	-	-	FAC	vpa?
<i>Echinochloa crus-galli</i>	Barnyard grass	non-native	annual grass	-	-	FACW	-
<i>Echinodorus berteroi</i>	Burhead	native	perennial herb (aquatic)	-	-	OBL	vpa?
<i>Egeria densa</i>	Brazilian water weed	non-native (invasive)	perennial herb	-	High	OBL	-
<i>Eichhornia crassipes</i>	Water hyacinth	non-native (invasive)	perennial herb	-	High	OBL	-
<i>Eleocharis macrostachya</i>	Spike rush	native	perennial grasslike herb	-	-	OBL	vpi?
<i>Elymus glaucus</i>	Blue wildrye	native	perennial grass	-	-	FACU	gen
<i>Elymus ponticus</i>	Tall wheat grass	non-native	perennial grass	-	-	-	-
<i>Elymus triticoides</i>	Beardless wild rye	native	perennial grass	-	-	FAC	gen
<i>Epilobium brachycarpum</i>	Willow herb	native	annual herb	-	-	-	gen

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Erigeron bonariensis</i>	Flax-leaved horseweed	non-native	annual herb	-	-	FACU	-
<i>Erigeron canadensis</i>	Canada horseweed	native	annual herb	-	-	FACU	gen
<i>Erodium cicutarium</i>	Coastal heron's bill	non-native (invasive)	annual herb	-	Limited	-	gen
<i>Erodium moschatum</i>	Whitestem filaree	non-native	annual herb	-	-	-	gen
<i>Eucalyptus camaldulensis</i>	Red gum	non-native (invasive)	tree	-	Limited	FAC	-
<i>Eucalyptus globulus</i>	Blue gum	non-native (invasive)	tree	-	Limited	-	-
<i>Eucalyptus sideroxylon</i>	Red iron bark	non-native	tree	-	-	-	-
<i>Euthamia occidentalis</i>	Western goldenrod	native	perennial herb	-	-	FACW	-
<i>Festuca arundinacea</i>	Reed fescue	non-native (invasive)	perennial grass	-	Moderate	FACU	-
<i>Festuca perennis</i>	Italian rye grass	non-native (invasive)	annual, perennial grass	-	Moderate	FAC	gen
<i>Ficus carica</i>	Common fig	non-native (invasive)	tree	-	Moderate	FACU	-
<i>Foeniculum vulgare</i>	Fennel	non-native (invasive)	perennial herb	-	High	-	-

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Frankenia salina</i>	Alkali heath	native	perennial herb	-	-	FACW	vpa?
<i>Geranium dissectum</i>	Wild geranium	non-native (invasive)	annual herb	-	Limited	-	gen
<i>Helenium bigelovii</i>	Bigelow's sneezeweed	native	perennial herb	-	-	FACW	-
<i>Helenium puberulum</i>	Sneezeweed	native	perennial herb	-	-	FACW	-
<i>Helianthus annuus</i>	Hairy leaved sunflower	native	annual herb	-	-	FACU	-
<i>Heliotropium curassavicum</i> var. <i>oculatum</i>	Seaside heliotrope	native	perennial herb	-	-	FACU	-
<i>Helminthotheca echioides</i>	Bristly ox-tongue	non-native (invasive)	annual, perennial herb	-	Limited	FAC	-
<i>Hibiscus lasiocarpus</i> var. <i>occidentalis</i>	Woolly rose-mallow	native	perennial herb	Rank 1B.2	-	OBL	-
<i>Hirschfeldia incana</i>	Short-podded mustard	non-native (invasive)	perennial herb	-	Moderate	-	-
<i>Hordeum brachyantherum</i>	Meadow barley	native	perennial grass	-	-	FACW	gen
<i>Hordeum jubatum</i> ssp. <i>jubatum</i>	Foxtail barley	native	perennial grass	-	-	FAC	-
<i>Hordeum marinum</i> ssp. <i>gussoneanum</i>	Barley	non-native (invasive)	annual grass	-	Moderate	FAC	gen
<i>Hordeum murinum</i>	Foxtail barley	non-native (invasive)	annual grass	-	Moderate	FACU	-

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Hydrocotyle</i> sp.	Pennywort	native	perennial herb	-	-	OBL	-
<i>Juglans hindsii</i>	Northern california black walnut	native	tree	Rank 1B.1*	-	FAC	-
<i>Juncus balticus</i> ssp. <i>ater</i>	Baltic rush	native	perennial grasslike herb	-	-	FACW	-
<i>Juncus bufonius</i>	Common toad rush	native	annual grasslike herb	-	-	FACW	vpa?
<i>Juncus effusus</i>	Common bog rush	native	perennial grasslike herb	-	-	FACW	-
<i>Juncus mexicanus</i>	Mexican rush	native	perennial grasslike herb	-	-	FACW	gen
<i>Juncus patens</i>	Rush	native	perennial grasslike herb	-	-	FACW	-
<i>Juncus xiphioides</i>	Iris leaved rush	native	perennial grasslike herb	-	-	OBL	gen
<i>Kickxia elatine</i>	Sharp point fluellin	non-native	perennial herb	-	-	UPL	-
<i>Kickxia spuria</i>	Fluellin	non-native	perennial herb	-	-	-	-
<i>Lactuca saligna</i>	Willow lettuce	non-native	annual herb	-	-	UPL	-
<i>Lactuca serriola</i>	Prickly lettuce	non-native	annual herb	-	-	FACU	-
<i>Lasthenia californica</i> ssp. <i>californica</i>	California goldfields	native	annual herb	-	-	FACU	-
<i>Lathyrus jepsonii</i> var. <i>californicus</i>	California tule pea	native	perennial herb	-	-	OBL	-

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Lemna</i> sp.	Duckweed	native	perennial herb	-	-	OBL	-
<i>Lepidium latifolium</i>	Perennial pepperweed	non-native (invasive)	perennial herb	-	High	FAC	-
<i>Leptochloa fusca</i>	Sprangletop	native	annual grass	-	-	FACW	-
<i>Lilaeopsis masonii</i>	Mason's lilaeopsis	native	perennial herb	SR, Rank 1B.1	-	OBL	-
<i>Limonium</i> sp.	-	-	-	-	-	-	-
<i>Lotus corniculatus</i>	Bird's foot trefoil	non-native	perennial herb	-	-	FAC	gen
<i>Ludwigia hexapetala</i>	Six petal water primrose	non-native (invasive)	perennial herb	-	High	-	-
<i>Ludwigia peploides</i> ssp. <i>peploides</i>	Floating water primrose	non-native (invasive)	perennial herb	-	High	OBL	-
<i>Lythrum californicum</i>	Common loosestrife	native	perennial herb	-	-	OBL	-
<i>Lythrum hyssopifolia</i>	Hyssop loosestrife	non-native (invasive)	annual, perennial herb	-	Limited	OBL	vpa?
<i>Maclura pomifera</i>	Osage orange	non-native	tree, shrub	-	-	UPL	-
<i>Malva nicaeensis</i>	Bull mallow	non-native	annual herb	-	-	-	-
<i>Malva pseudolavatera</i>	Cretan mallow	non-native	shrub	-	-	-	-
<i>Malvella leprosa</i>	Alkali mallow	native	perennial herb	-	-	FACU	gen

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Marrubium vulgare</i>	White horehound	non-native (invasive)	perennial herb	-	Limited	FACU	-
<i>Medicago polymorpha</i>	California burclover	non-native (invasive)	annual herb	-	Limited	FACU	-
<i>Medicago sativa</i>	Alfalfa	non-native	perennial herb	-	-	UPL	-
<i>Melilotus albus</i>	White sweetclover	non-native	annual, biennial herb	-	-	-	-
<i>Melilotus indicus</i>	Annual yellow sweetclover	non-native	annual herb	-	-	FACU	-
<i>Mentha pulegium</i>	Pennyroyal	non-native (invasive)	perennial herb	-	Moderate	OBL	vpa?
<i>Morus alba</i>	Mulberry	non-native	tree	-	-	FACU	-
<i>Nerium oleander</i>	Oleander	non-native	tree	-	-	-	-
<i>Paspalum dilatatum</i>	Dallis grass	non-native	perennial grass	-	-	FAC	-
<i>Paspalum distichum</i>	Knot grass	native	perennial grass	-	-	FACW	-
<i>Persicaria amphibia</i>	Water smartweed	native	perennial herb (aquatic)	-	-	OBL	-
<i>Persicaria lapathifolia</i>	Common knotweed	native	annual herb	-	-	FACW	-
<i>Persicaria punctata</i>	Dotted smartweed	native	perennial herb	-	-	OBL	-

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Phalaris aquatica</i>	Harding grass	non-native (invasive)	perennial grass	-	Moderate	FACU	-
<i>Phalaris lemmonii</i>	Lemmon's canarygrass	native	annual grass	-	-	FACW	vpa?
<i>Phalaris paradoxa</i>	Hood canarygrass	non-native	annual grass	-	-	FAC	vpa?
<i>Phoenix canariensis</i>	Canary island date palm	non-native (invasive)	tree	-	Limited	-	-
<i>Phoradendron leucarpum</i>	American mistletoe	native	shrub (parasitic)	-	-	-	-
<i>Phragmites australis</i>	Common reed	native	perennial grass	-	-	FACW	-
<i>Phyla nodiflora</i>	Common lippia	native	perennial herb	-	-	FACW	-
<i>Plantago lanceolata</i>	Ribwort	non-native (invasive)	perennial herb	-	Limited	FAC	gen
<i>Plantago major</i>	Common plantain	non-native	perennial herb	-	-	FAC	-
<i>Platanus racemosa</i>	California sycamore	native	tree	-	-	FAC	-
<i>Poa annua</i>	Annual blue grass	non-native	annual grass	-	-	FAC	gen
<i>Poa pratensis</i> ssp. <i>pratensis</i>	Kentucky blue grass	non-native (invasive)	perennial grass	-	Limited	FAC	-
<i>Polygonum aviculare</i>	Prostrate knotweed	non-native	annual, perennial herb	-	-	FAC	gen

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Polypogon australis</i>	Chilean beard grass	non-native	perennial grass	-	-	FACW	-
<i>Polypogon monspeliensis</i>	Annual beard grass	non-native (invasive)	annual grass	-	Limited	FACW	vpa?
<i>Populus alba</i>	White poplar	non-native	tree	-	-	-	-
<i>Populus fremontii</i> ssp. <i>fremontii</i>	Cottonwood	native	tree	-	-	FAC	-
<i>Puccinellia distans</i>	European alkali grass	non-native	perennial grass	-	-	FACW	-
<i>Quercus lobata</i>	Valley oak	native	tree	-	-	FACU	-
<i>Ranunculus californicus</i>	Common buttercup	native	perennial herb	-	-	FACU	gen
<i>Ranunculus muricatus</i>	Buttercup	non-native	annual, perennial herb	-	-	FACW	vpa?
<i>Raphanus sativus</i>	Radish	non-native (invasive)	annual, biennial herb	-	Limited	-	-
<i>Rorippa palustris</i>	Bog yellow cress	native	annual, perennial herb	-	-	OBL	-
<i>Rosa californica</i>	California wild rose	native	shrub	-	-	FAC	-
<i>Rubus armeniacus</i>	Himalayan blackberry	non-native (invasive)	shrub	-	High	FAC	-
<i>Rubus ursinus</i>	California blackberry	native	vine, shrub	-	-	FAC	-
<i>Rumex acetosella</i>	Sheep sorrel	non-native (invasive)	perennial herb	-	Moderate	FACU	gen

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Rumex crispus</i>	Curly dock	non-native (invasive)	perennial herb	-	Limited	FAC	gen
<i>Rumex dentatus</i>	Toothed dock	non-native	annual, perennial herb	-	-	FACW	vpa?
<i>Rumex fueginus</i>	Golden dock	native	annual, perennial herb	-	-	FACW	-
<i>Rumex pulcher</i>	Fiddleleaf dock	non-native	perennial herb	-	-	FAC	gen
<i>Sagittaria latifolia</i>	Broad leaf arrowhead	native	perennial herb (aquatic)	-	-	OBL	-
<i>Salix exigua</i>	Narrowleaf willow	native	tree, shrub	-	-	FACW	-
<i>Salix gooddingii</i>	Gooding's willow	native	tree	-	-	FACW	-
<i>Salix laevigata</i>	Polished willow	native	tree	-	-	FACW	-
<i>Salix lasiolepis</i>	Arroyo willow	native	tree, shrub	-	-	FACW	-
<i>Sambucus nigra ssp. caerulea</i>	Blue elderberry	native	shrub	-	-	FAC	-
<i>Samolus parviflorus</i>	Water pimpernel	native	perennial herb	-	-	OBL	-
<i>Schoenoplectus acutus var. occidentalis</i>	Tule	native	perennial grasslike herb	-	-	OBL	-
<i>Schoenoplectus californicus</i>	California bulrush	native	perennial grasslike herb	-	-	OBL	-
<i>Setaria sp.</i>	Bristle grass	non-native	annual grass	-	-	-	-

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Silybum marianum</i>	Milk thistle	non-native (invasive)	annual, perennial herb	-	Limited	-	-
<i>Solanum</i> sp.	Nightshade	-	-	-	-	-	-
<i>Sonchus asper</i> ssp. <i>asper</i>	Sow thistle	non-native	annual herb	-	-	FAC	-
<i>Sonchus oleraceus</i>	Sow thistle	non-native	annual herb	-	-	UPL	-
<i>Sorghum halepense</i>	Johnsongrass	non-native	perennial grass	-	-	FACU	-
<i>Sparganium eurycarpum</i>	Broadfruit bur reed	native	perennial herb	-	-	OBL	-
<i>Spergularia rubra</i>	Purple sand spurry	non-native	annual, perennial herb	-	-	FAC	gen
<i>Sporobolus indicus</i>	Smutgrass	non-native	perennial grass	-	-	FACU	-
<i>Stachys albens</i>	Cobwebby hedge nettle	native	perennial herb	-	-	OBL	-
<i>Symphyotrichum chilense</i>	Pacific aster	native	perennial herb	-	-	FAC	-
<i>Symphyotrichum lentum</i>	Suisun marsh aster	native	perennial herb (rhizomatous)	Rank 1B.2	-	OBL	-
<i>Symphyotrichum subulatum</i>	Eastern annual saltmarsh aster	native	annual herb	-	-	OBL	-
<i>Tamarix</i> sp.	Tamarisk	non-native	tree, shrub	-	-	-	-
<i>Toxicodendron diversilobum</i>	Poison oak	native	vine, shrub	-	-	FACU	-

Scientific Name	Common Name	Origin	Form	Rarity Status ¹	CAL-IPC Status ²	Wetland Status ³	Vernal Pool Status ⁴
<i>Tragopogon porrifolius</i>	Salsify	non-native	perennial herb	-	-	-	-
<i>Tribulus terrestris</i>	Puncture vine	non-native (invasive)	annual herb	-	Limited	-	-
<i>Trifolium fragiferum</i>	Strawberry clover	non-native	perennial herb	-	-	FAC	-
<i>Trifolium repens</i>	White clover	non-native	perennial herb	-	-	FACU	-
<i>Typha angustifolia</i>	Narrow leaf cattail	non-native	perennial herb (aquatic)	-	-	OBL	-
<i>Typha domingensis</i>	Cattail	native	perennial herb	-	-	OBL	-
<i>Typha latifolia</i>	Broadleaf cattail	native	perennial herb (aquatic)	-	-	OBL	-
<i>Urtica dioica</i>	Stinging nettle	native	perennial herb	-	-	FAC	-
<i>Verbena lasiostachys</i>	Western vervain	native	perennial herb	-	-	FAC	-
<i>Vicia sativa</i>	Spring vetch	non-native	annual herb, vine	-	-	FACU	-
<i>Vitis californica</i>	California wild grape	native	vine, shrub	-	-	FACU	-
<i>Washingtonia robusta</i>	Washington fan palm	non-native (invasive)	tree	-	Moderate	FACW	-
<i>Xanthium spinosum</i>	Spiny cocklebur	native	annual herb	-	-	FACU	-
<i>Xanthium strumarium</i>	Cocklebur	native	annual herb	-	-	FAC	gen
<i>Zeltnera muehlenbergii</i>	Muehlenberg's centaury	native	annual herb	-	-	FAC	gen

Scientific Name	Common Name
Mammals	
<i>Castor canadensis</i>	North American beaver
<i>Lepus californicus</i>	blacktailed jackrabbit
<i>Lontra canadensis</i>	river otter
<i>Mephitis mephitis</i>	striped skunk
<i>Ondatra zibethicus</i>	muskrat
<i>Zalophus californianus</i>	California sea lion
Birds	
<i>Agelaius phoeniceus</i>	red-winged blackbird
<i>Anas acuta</i>	northern pintail
<i>Anas americana</i>	American wigeon
<i>Anas carolinensis</i>	green-winged teal
<i>Anas clypeata</i>	northern shovler
<i>Anas platyrhynchos</i>	mallard
<i>Anas strepera</i>	gadwall
<i>Aphelocoma californica</i>	California scrub jay
<i>Ardea alba</i>	great egret
<i>Ardea herodias</i>	great blue heron
<i>Aythya valisineria</i>	canvasback
<i>Botaurus lentiginosus</i>	American bittern

Scientific Name	Common Name
<i>Branta canadensis</i>	Canada goose
<i>Bucephala albeola</i>	bufflehead
<i>Buteo jamaicensis</i>	red-tailed hawk
<i>Buteo swainsoni</i>	Swainson's hawk
<i>Cathartes aura</i>	turkey vulture
<i>Charadrius vociferus</i>	killdeer
<i>Chen caerulescens</i>	snow goose
<i>Circus cyaneus</i>	northern harrier
<i>Cistothorus palustris</i>	marsh wren
<i>Colaptes auratus</i>	northern flicker
<i>Columba livia</i>	rock pigeon
<i>Corvus brachyrhynchos</i>	American crow
<i>Egretta thula</i>	snowy egret
<i>Euphagus cyanocephalus</i>	Brewer's blackbird
<i>Falco sparverius</i>	American kestrel
<i>Fulica americana</i>	American coot
<i>Haemorhous mexicanus</i>	house finch
<i>Hirundo rustica</i>	barn swallow
<i>Lanius ludovicianus</i>	loggerhead shrike
<i>Larus occidentalis</i>	western gull
<i>Larus sp.</i>	gull sp.

Scientific Name	Common Name
<i>Megaceryle alcyon</i>	belted kingfisher
<i>Melanerpes formicivorus</i>	acorn woodpecker
<i>Melospiza melodia</i>	song sparrow
<i>Mimus polyglottos</i>	northern mockingbird
<i>Molothrus ater</i>	brown headed cowbird
<i>Nycticorax nycticorax</i>	black-crowned night heron
<i>Pandion haliaetus</i>	osprey
<i>Pavo spp.</i>	peafowl
<i>Pelecanus erythrorhynchos</i>	American white pelican
<i>Phalacrocorax auritus</i>	double-crested cormorant
<i>Phasianus colchicus</i>	ring-necked pheasant
<i>Pica nuttalli</i>	yellow-billed magpie
<i>Plegadis chihi</i>	white-faced ibis
<i>Podiceps nigricollis</i>	eared grebe
<i>Podilymbus podiceps</i>	pied-billed grebe
<i>Quiscalus mexicanus</i>	great-tailed grackle
<i>Sayornis nigricans</i>	black phoebe
<i>Sayornis saya</i>	Say's phoebe
<i>Setophaga coronata</i>	yellow-rumped warbler
<i>Sturnella neglecta</i>	western meadowlark

Scientific Name	Common Name
<i>Sturnus vulgaris</i>	European starling
<i>Tringa melanoleuca</i>	greater yellowlegs
<i>Tringa spp.</i>	yellowlegs spp.
<i>Turdus migratorius</i>	American robin
<i>Tyrannus verticalis</i>	western kingbird
<i>Zenaida macroura</i>	mourning dove
<i>Zonotrichia leucophrys</i>	white-crowned sparrow
Reptiles and Amphibians	
<i>Lithobates catesbeianus</i>	American bullfrog
<i>Actinemys marmorata</i>	Western pond turtle
<i>Sceloporus occidentalis</i>	Western fence lizard
<i>Thamnophis sirtalis fitchi</i>	valley garter snake
<i>Thamnophis gigas</i>	giant garter snake
Fish	
<i>Ameiurus nebulosus</i>	brown bullhead
<i>Carassius auratus</i>	goldfish
<i>Catostomus occidentalis</i>	Sacramento sucker
<i>Cottus asper</i>	prickly sculpin
<i>Dorosoma petenense</i>	threadfin shad
<i>Gambusia affinis</i>	western mosquitofish
<i>Hypomesus nipponensis</i>	wakasagi

Scientific Name	Common Name
<i>Hysterothorax traskii</i>	tule perch
<i>Lepomis gibbosus</i>	pumpkinseed
<i>Lepomis gulosus</i>	warmouth
<i>Lepomis macrochirus</i>	bluegill
<i>Menidia beryllina</i> ssp.	Mississippi silverside
<i>Micropterus dolomieu</i>	smallmouth bass
<i>Micropterus punctulatus</i>	spotted bass
<i>Micropterus salmoides</i>	largemouth bass
<i>Notemigonus crysoleucas</i>	golden shiner
<i>Percina macrolepida</i>	bigscale logperch
<i>Pogonichthys macrolepidotus</i>	Sacramento splittail
<i>Pomoxis annularis</i>	white crappie
<i>Pomoxis nigromaculatus</i>	black crappie
Invertebrates	
<i>Procambarus clarkii</i>	red swamp crayfish
<i>Neotrypaea californiensis</i>	ghost shrimp

▪ All plant species identified using the *Jepson eFlora* [Jepson Flora Project (eds.) 2019]; nomenclature follows *Jepson eFlora* [Jepson Flora Project (eds.) 2019]
 *Special-status only at native occurrences. The Study Area does not contain a native occurrence of this species.

¹ California Native Plant Society. 2018. Inventory of Rare and Endangered Plants (online edition, v8-03 0.39). Sacramento, California. Online at: <http://rareplants.cnps.org/>; most recently accessed: August 2018

FE: Federal Endangered
 FT: Federal Threatened
 SE: State Endangered
 ST: State Threatened

SR: State Rare
Rank 1A: Plants presumed extinct in California
Rank 1B: Plants rare, threatened, or endangered in California and elsewhere
Rank 2: Plants rare, threatened, or endangered in California, but more common elsewhere
Rank 3: Plants about which we need more information – a review list
Rank 4: Plants of limited distribution – a watch list

² **California Invasive Plant Council. 2018. California Invasive Plant Inventory Database. California Invasive Plant Council, Berkeley, CA. Online at: <http://www.cal-ipc.org/paf/>; most recently accessed: August 2018**

High: Severe ecological impacts; high rates of dispersal and establishment; most are widely distributed ecologically.
Moderate: Substantial and apparent ecological impacts; moderate-high rates of dispersal, establishment dependent on disturbance; limited-moderate distribution ecologically
Limited: Minor or not well documented ecological impacts; low-moderate rate of invasiveness; limited distribution ecologically
Assessed: Assessed by Cal-IPC and determined to not be an existing current threat

³ **Lichvar, R.W., D.L. Banks, W.N. Kirchner, and N.C. Melvin. 2016. The National Wetland Plant List: 2016 wetland ratings. Phytoneuron 2016-30: 1-17. Published 28 April 2016. ISSN 2153 733X**

OBL: Almost always found in wetlands
FACW: Usually found in wetlands
FAC: Equally found in wetlands and uplands
FACU: Usually not found in wetlands
UPL: Almost never found in wetlands
NL: Not listed, assumed almost never found in wetlands
NI: No information; not factored during wetland delineation

⁴ **Keeler-Wolf, T., D.R. Elam, K. Lewis, and S.A. Flint. 1998. California Vernal Pool Assessment Preliminary Report. The Resources Agency, California Department of Fish and Game, Sacramento, CA. 161 pp. with appendices**

VPI: Species restricted to vernal pools and not known from other habitats
VPA: Species regularly occurring in vernal pools, but not restricted to them; also occurring in other wetland habitats
GEN: Species that can occur in wetland or upland, or sometimes both, including vernal pools, pool margins, disturbed areas, and grasslands
VPI?: Species that is VPI in certain region(s) only, and can be a VPA or GEN in other regions
VPA?: Species that is VPA in certain region(s), and is GEN in other regions
VPI/VPA: Species that is VPI in some regions and VPA in other regions, but not known to be GEN

APPENDIX C

POTENTIAL FOR SPECIAL-STATUS PLANT AND WILDLIFE SPECIES
TO OCCUR IN THE STUDY AREA

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Appendix C1. Potential for special-status plant species to occur in the Study Area. List compiled from the U.S. Fish and Wildlife Service (USFWS) Information for Conservation and Planning Database (USFWS 2018a), the California Department of Fish and Wildlife (CDFW) Natural Diversity Database (CDFW 2018a), and the California Native Plant Society (CNPS) Inventory of Rare and Endangered Plants (CNPS 2018) for the Dixon, Saxon, Clarksburg, Dozier, Liberty Island, Courtland, Bird's Landing, Rio Vista and Isleton USGS 7.5-minute quadrangles.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Ferris' milk-vetch <i>Astragalus tener</i> var. <i>ferrisiae</i>	Rank 1B.1	Meadows and seeps (vernally mesic), valley and foothill grassland (subalkaline flats). Elevation ranges from 5 to 245 feet (2 to 75 meters). Blooms Apr-May.	Unlikely. The Study Area does not contain meadow or seep habitats. Although grassland is present, this species is commonly associated with vernal pools, which are absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
alkali milk-vetch <i>Astragalus tener</i> var. <i>tener</i>	Rank 1B.2	Playas, valley and foothill grassland (adobe clay), vernal pools. Elevation ranges from 0 to 195 feet (1 to 60 meters). Blooms Mar-Jun.	Unlikely. Although grassland is present, this species is commonly associated with vernal pools and playas, which are absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
heartscale <i>Atriplex cordulata</i> var. <i>cordulata</i>	Rank 1B.2	Chenopod scrub, meadows and seeps, valley and foothill grassland (sandy). Elevation ranges from 0 to 1835 feet (0 to 560 meters). Blooms Apr-Oct.	Unlikely. The Study Area does not contain chenopod scrub habitat. Although the Study Area contains grassland, this species occurs in seasonally mesic, strongly alkaline substrate, which is absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history, lack of suitable habitat, and the fact that this species was not observed during protocol level rare plant surveys that occurred during the period of time when it would have been identifiable, heartscale is assumed to be absent from the Study Area. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
brittlescale <i>Atriplex depressa</i>	Rank 1B.2	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland, vernal pools. Elevation ranges from 0 to 1050 feet (1 to 320 meters). Blooms Apr-Oct.	Unlikely. The Study Area does not contain chenopod scrub, meadow, or seep habitats. Although the Study Area contains grassland, this species occurs in vernal pools and playas in strongly alkaline substrate, and such habitat is absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history, lack of suitable habitat, and the fact that this species was not observed during protocol level rare plant surveys that occurred during the period of time when it would have been identifiable, brittlescale is assumed to be absent from the Study Area. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
vernal pool smallscale <i>Atriplex persistens</i>	Rank 1B.2	Vernal pools (alkaline). Elevation ranges from 30 to 375 feet (10 to 115 meters). Blooms Jun, Aug, Sep, Oct.	Unlikely. The Study Area does not contain vernal pools. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history, lack of suitable habitat, and the fact that this species was not observed during protocol level rare plant surveys that occurred during the period of time when it would have been identifiable, vernal pool smallscale is assumed to be absent from the Study Area. No further actions are recommended.
watershield <i>Brasenia schreberi</i>	Rank 2B.3	Marshes and swamps (freshwater). Elevation ranges from 10 to 7220 feet (3 to 2200 meters). Blooms Jun-Sep.	Moderate Potential. The Study Area contains potentially suitable marsh habitat.	Not Observed. This species was not observed during protocol level rare plant surveys that occurred during the period of time when it would have been identifiable and during times when it would not have been obscured by high tides. It is therefore assumed to be absent from the Study Area. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
bristly sedge <i>Carex comosa</i>	Rank 2B.1	Coastal prairie, marshes and swamps (lake margins), valley and foothill grassland. Elevation ranges from 0 to 2050 feet (0 to 625 meters). Blooms May-Sep.	Moderate Potential. The Study Area contains potentially suitable marsh habitat.	Not Observed. This large, perennial species was not observed during protocol level rare plant surveys that occurred during the period of time when it would have been identifiable and during times when it would not have been obscured by high tides. It is therefore assumed to be absent from the Study Area. No further actions are recommended.
pappose tarplant <i>Centromadia parryi</i> ssp. <i>parryi</i>	Rank 1B.2	Chaparral, coastal prairie, meadows and seeps, marshes and swamps (coastal salt), valley and foothill grassland (vernally mesic). Elevation ranges from 0 to 1380 feet (0 to 420 meters). Blooms May-Nov.	Moderate Potential. This taxon is disturbance-adapted, and potentially suitable habitat is present along fence-lines, roads, and levees outside of irregular, managed hydrology.	Not Observed. This species was not observed during protocol level rare plant surveys that occurred during the period of time when it would have been identifiable, and it is therefore assumed to be absent from the Study Area. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Parry's rough tarplant <i>Centromadia parryi</i> ssp. <i>rudis</i>	Rank 4.2	Valley and foothill grassland, vernal pools. Elevation ranges from 0 to 330 feet (0 to 100 meters). Blooms May-Oct.	Moderate Potential. This species is disturbance adapted, and potentially suitable habitat is present along fence-lines, roads, and levees outside of irregular, managed hydrology.	Present. Approximately 348 individuals were observed on and adjacent to levee roads within the non-native grassland community on Bowsbey Ranch and ten individuals at were observed at one location (alongside a levee road in the same biological community) on the Vogel property.
Bolander's water-hemlock <i>Cicuta maculata</i> var. <i>bolanderi</i>	Rank 2B.1	Marshes and swamps coastal, fresh or brackish water. Elevation ranges from 0 to 655 feet (0 to 200 meters). Blooms Jul-Sep.	Moderate Potential. The Study Area contains potentially suitable marsh habitat.	Not Observed. This species was not observed during protocol level rare plant surveys that occurred during the period of time when it would have been identifiable, and it is therefore assumed to be absent from the Study Area. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
dwarf downingia <i>Downingia pusilla</i>	Rank 2B.2	Valley and foothill grassland (mesic), vernal pools. Elevation ranges from 0 to 1460 feet (1 to 445 meters). Blooms Mar-May.	Unlikely. Although the Study Area contains grassland, this species is restricted to vernal pools, which are absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Jepson's coyote thistle <i>Eryngium jepsonii</i>	Rank 1B.2	Valley and foothill grassland, vernal pools. Elevation ranges from 5 to 985 feet (3 to 300 meters). Blooms Apr-Aug.	Unlikely. Although the Study Area contains grassland, this species is restricted to vernal pools, which are absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species	Not Observed. Because of site history, lack of suitable habitat, and the fact that this species was not observed during protocol level rare plant surveys that occurred during the period of time when it would have been identifiable, Jepson's coyote thistle is assumed to be absent from the Study Area. No further actions are recommended.
San Joaquin spearscale <i>Extriplex joaquinana</i>	Rank 1B.2	Chenopod scrub, meadows and seeps, playas, valley and foothill grassland. Elevation ranges from 0 to 2740 feet (1 to 835 meters). Blooms Apr-Oct.	Moderate Potential. The Study Area does not contain chenopod scrub, meadow, or seep habitats. Much of the grassland present is unlikely to support this species because of irregular, managed hydrologic regimes. However, this species is disturbance-tolerant and has potential to occur along fence-lines, roads, and levees outside of irregular, managed hydrology.	Not Observed. This species was not observed during protocol level rare plant surveys that occurred during the period of time when it would have been identifiable, and it is therefore assumed to be absent from the Study Area. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
fragrant fritillary <i>Fritillaria liliacea</i>	Rank 1B.2	Cismontane woodland, coastal prairie, coastal scrub, valley and foothill grassland. Elevation ranges from 5 to 1345 feet (3 to 410 meters). Blooms Feb-Apr.	Unlikely. The Study Area does not contain woodland, prairie, or coastal scrub habitats or serpentine substrate. Grassland within the Study Area is unlikely to support this species because of irregular, managed hydrologic regimes or high levels of disturbance. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.
adobe-lily <i>Fritillaria pluriflora</i>	Rank 1B.2	Chaparral, cismontane woodland, valley and foothill grassland. Elevation ranges from 195 to 2315 feet (60 to 705 meters). Blooms Feb-Apr.	Unlikely. The Study Area does not contain chaparral habitat or serpentine substrate. Forested areas within the Study Area are not suitable for this species because the canopy is dense and they typically occur on disturbed landforms such as levee banks. Grassland within the Study Area is unlikely to support this species because of irregular, managed hydrologic regimes or high levels of disturbance. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Boggs Lake hedge-hyssop <i>Gratiola heterosepala</i>	SE, Rank 1B.2	Marshes and swamps (lake margins), vernal pools. Elevation ranges from 30 to 7790 feet (10 to 2375 meters). Blooms Apr-Aug.	Unlikely. The Study Area does not contain vernal pools. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
hogwallow starfish <i>Hesperivax caulescens</i>	Rank 4.2	Valley and foothill grassland (mesic, clay), vernal pools (shallow). Elevation ranges from 0 to 1655 feet (0 to 505 meters). Blooms Mar-Jun.	Unlikely. The Study Area does not contain vernal pools. Grassland within the Study Area is unlikely to support this species because of irregular, managed hydrologic regimes or high levels of disturbance. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking statewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.
woolly rose-mallow <i>Hibiscus lasiocarpus</i> var. <i>occidentalis</i>	Rank 1B.2	Marshes and swamps (freshwater). Elevation ranges from 0 to 395 feet (0 to 120 meters). Blooms Jun-Sep.	High Potential. The Study Area contains potentially suitable marsh habitat, and there are recent documented occurrences nearby.	Present. Approximately 80 woolly rose-mallow individuals were observed among emergent vegetation located along the eastern bank of Sycamore Slough in the southwestern portion of Bowsbey Ranch.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Carquinez goldenbush <i>Isocoma arguta</i>	Rank 1B.1	Valley and foothill grassland (alkaline). Elevation ranges from 0 to 65 feet (1 to 20 meters). Blooms Aug-Dec.	Unlikely. Grassland within the Study Area is unlikely to support this species because of irregular, managed hydrologic regimes or high levels of disturbance. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history, lack of suitable habitat, and the fact that this species was not observed during protocol level rare plant surveys that occurred during its blooming period, Carquinez goldenbush is assumed to be absent from the Study Area. No further actions are recommended.
Northern California black walnut <i>Juglans hindsii</i>	Rank 1B.1	Riparian forest, riparian woodland. Elevation ranges from 0 to 1445 feet (0 to 440 meters). Blooms Apr-May.	No Potential. This species is widespread in northern California but is only considered special-status at a small number of native occurrences. This species was historically widely planted outside of its native occurrences because of agriculture and has since spread from those planted populations. Plants occurring outside of native occurrences are considered naturalized. The Study Area is not located at one of the native occurrences. Additionally, because the Study Area has been completely altered from historic conditions, there is no possibility of the Study Area being a previously unknown native occurrence.	Although this species was observed within the Study Area, because the Study Area is not part of a native occurrence, the individuals observed are not considered special-status. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Delta tule pea <i>Lathyrus jepsonii</i> var. <i>jepsonii</i>	Rank 1B.2	Marshes and swamps (freshwater and brackish). Elevation ranges from 0 to 15 feet (0 to 5 meters). Blooms May-Jul (Aug-Sep).	High Potential. The Study Area contains potentially suitable marsh habitat, and there are recent documented occurrences within the Study Area and nearby. CNDDDB occurrence #52 mapped within the Study Area in 1994 along the levee bank of Hass Slough north of Vogel Island	Not Observed. This species was not observed during protocol level rare plant surveys that occurred its blooming period. The mapped location of CNDDDB occurrence #52 is on a Corps flood control levee that presumably receives periodic maintenance. Species assumed to be absent from the Study Area. No further actions are recommended.
legenera <i>Legenera limosa</i>	Rank 1B.1	Vernal pools. Elevation ranges from 0 to 2885 feet (1 to 880 meters). Blooms Apr-Jun.	Unlikely. Vernal pools are not present within the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Heckard's pepper-grass <i>Lepidium latipes</i> var. <i>heckardii</i>	Rank 1B.2	Valley and foothill grassland (alkaline flats). Elevation ranges from 5 to 655 feet (2 to 200 meters). Blooms Mar-May.	Unlikely. CNDDDB Occurrence Record #7 is mapped in the Study Area. However, the occurrence record for this 1891 observation states "exact location unknown. Mapped by CNDDDB as best guess along the full extent of Haas Slough". Grassland within the Study Area is unlikely to support this species because of irregular, managed hydrologic regimes or high levels of disturbance. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Mason's lilaepsis <i>Lilaeopsis masonii</i>	SR, Rank 1B.1	Marshes and swamps (brackish or freshwater), riparian scrub. Elevation ranges from 0 to 35 feet (0 to 10 meters). Blooms Apr-Nov.	High Potential. The Study Area contains potentially suitable marsh habitat, and CNDDDB records 72 and 73 mapped within the Study Area in 2005 on Vogel Island and to the northwest along Hass Slough.	Approximately 12 occurrences were observed on the outboard side of levees within the tidal zone of the Vogel property.
Delta mudwort <i>Limosella australis</i>	Rank 2B.1	Marshes and swamps (freshwater or brackish), riparian scrub. Elevation ranges from 0 to 10 feet (0 to 3 meters). Blooms May-Aug.	Moderate. The Study Area contains potentially suitable muddy banks in the intertidal zone on portions of the outboard of the levees on the Vogel property. There are nearby occurrences, but none are recent.	Not Observed. This species was not observed during protocol level rare plant surveys that occurred during the period of time that it would have been identifiable, and it is therefore assumed to be absent from the Study Area. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
little mousetail <i>Myosurus minimus</i> ssp. <i>apus</i>	Rank 3.1	Valley and foothill grassland, vernal pools (alkaline). Elevation ranges from 65 to 2100 feet (20 to 640 meters). Blooms Mar-Jun.	<p>Unlikely. Vernal pools are not present within the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. Grassland within the Study Area is unlikely to support this species because of irregular, managed hydrologic regimes or high levels of disturbance. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.</p>	<p>Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.</p>

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Baker's navarretia <i>Navarretia leucocephala</i> ssp. <i>bakeri</i>	Rank 1B.1	Cismontane woodland, lower montane coniferous forest, meadows and seeps, valley and foothill grassland, vernal pools. Elevation ranges from 15 to 5710 feet (5 to 1740 meters). Blooms Apr-Jul.	Unlikely. The Study Area does not contain lower montane coniferous forest, meadow, or seep habitats. Although forested and grassland areas are present, this species occurs in vernal pools, which are absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Colusa grass <i>Neostapfia colusana</i>	FT, SE, Rank 1B.1	Vernal pools (adobe, large). Elevation ranges from 15 to 655 feet (5 to 200 meters). Blooms May-Aug.	Unlikely. Vernal pools are not present within the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
bearded popcornflower <i>Plagiobothrys hystriculus</i>	Rank 1B.1	Valley and foothill grassland (mesic), vernal pools margins. Elevation ranges from 0 to 900 feet (0 to 274 meters). Blooms Apr-May.	Unlikely. While the Study Area contains mesic grasslands, this species occurs in vernal pools and swales, which are absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
California alkali grass <i>Puccinellia simplex</i>	Rank 1B.2	Chenopod scrub, meadows and seeps, valley and foothill grassland, vernal pools. Elevation ranges from 5 to 3050 feet (2 to 930 meters). Blooms Mar-May.	Unlikely. The Study Area does not contain chenopod scrub, meadow, seep, or vernal pool habitats. While the Study Area contains grasslands, this species typically occurs in seasonally mesic areas which are naturally sparsely vegetated as a result of high salinity, and such habitat is absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Sanford's arrowhead <i>Sagittaria sanfordii</i>	Rank 1B.2	Marshes and swamps (assorted shallow freshwater). Elevation ranges from 0 to 2135 feet (0 to 650 meters). Blooms May-Oct (Nov).	Moderate Potential. The Study Area contains potentially suitable slow-moving or standing freshwater ditches. There are several occurrences approximately 2 to 3 miles east of the Study Area.	Not Observed. This species was not observed during protocol level rare plant surveys that occurred during the period of time that it would have been identifiable, and it is therefore assumed to be absent from the Study Area. No further actions are recommended.
side-flowering skullcap <i>Scutellaria lateriflora</i>	Rank 2B.2	Meadows and seeps (mesic), marshes and swamps. Elevation ranges from 0 to 1640 feet (0 to 500 meters). Blooms Jul-Sep.	Unlikely. While the Study Area contains marshes, the niche of the species is more freshwater than that found within the Study Area. Additionally, the species is often found on logs in the Delta region where water is likely less brackish than what occurs adjacent to the Study Area. The nearest occurrences of this species are approximately 11 miles east of the Study Area.	Not Observed. This species was not observed during protocol level rare plant surveys that occurred during the period of time that it would have been identifiable, and it is therefore assumed to be absent from the Study Area. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Keck's checkerbloom <i>Sidalcea keckii</i>	FE, Rank 1B.1	Cismontane woodland, valley and foothill grassland. Elevation ranges from 245 to 2135 feet (75 to 650 meters). Blooms Apr-May (Jun).	Unlikely. Although the Study Area contains forested areas, this species is most closely associated with blue oak woodland, which is absent from the Study Area. Grassland within the Study Area is unlikely to support this species because of irregular, managed hydrologic regimes or high levels of disturbance. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species. Furthermore, this species typically occurs on serpentine clay substrate, which is absent from the Study Area.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.
Suisun Marsh aster <i>Symphotrichum lentum</i>	Rank 1B.2	Marshes and swamps (brackish and freshwater). Elevation ranges from 0 to 10 feet (0 to 3 meters). Blooms (Apr)May-Nov.	High Potential. The Study Area contains suitable marsh habitat, and there are recent, nearby occurrences.	Present. Approximately 241 individuals of Suisun Marsh aster were observed in the Study Area. In total, 216 individuals were observed on the outboard side of the levee that parallels Shag Slough. The remaining 27 individuals of Suisun Marsh aster were observed on the outboard side of the levee that surrounds the Vogel property.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
saline clover <i>Trifolium hydrophilum</i>	Rank 1B.2	Marshes and swamps, valley and foothill grassland (mesic, alkaline), vernal pools. Elevation ranges from 0 to 985 feet (0 to 300 meters). Blooms Apr-Jun.	Unlikely. Although the Study Area contains grassland and marsh habitats, this species occurs in vernal pools or marsh fringes that are similar to vernal pools, and such habitat is absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE	RESULTS AND RECOMMENDATIONS
Plants				
Crampton's tuctoria or Solano grass <i>Tuctoria mucronata</i>	FE, SE, Rank 1B.1	Valley and foothill grassland (mesic), vernal pools. Elevation ranges from 15 to 35 feet (5 to 10 meters). Blooms Apr-Aug.	Unlikely. Although grassland is present, this species is restricted to vernal pools, which are absent from the Study Area. Nearly all areas that are not perennially inundated within the Study Area have an irregular, managed hydrologic regime, which is not suitable for this species. The three small seasonal wetland features that do not have managed hydrology are lacking vernal pool indicator (Keeler-Wolf et al. 1998) species, which are also lacking sitewide. In addition, the Study Area is almost entirely diked marshland, greatly reducing the likelihood that the seed bank would contain this species.	Not Observed. Because of site history and lack of suitable habitat, this species is assumed to be absent from the Study Area. In addition, this species was not observed during site assessments conducted during its blooming period. No further actions are recommended.

*** Key to status codes:**

FE	Federal Endangered
FT	Federal Threatened
FD	Federal Delisted
FC	Federal Candidate
SE	State Endangered
ST	State Threatened
SD	State Delisted
SC	State Candidate

California Rare Plant Ranks:

Rank 1A	California Rare Plant Rank 1A: Presumed extirpated in California and either rare or extinct elsewhere
Rank 1B	California Rare Plant Rank 1B: Plants rare, threatened or endangered in California and elsewhere
Rank 2B	California Rare Plant Rank 2B: Plants rare, threatened, or endangered in California, but more common elsewhere
Rank 3	California Rare Plant Rank 3: Plants about which CNPS needs more information (a review list)
Rank 4	California Rare Plant Rank 4: Plants of limited distribution (a watch list)

Threat Ranks for California Rare Plant Rank Plant Species

0.1	Seriously threatened in California (over 80% of occurrences threatened / high degree and immediacy of threat)
0.2	Moderately threatened in California (20-80% occurrences threatened / moderate degree and immediacy of threat)
0.3	Not very threatened in California (less than 20% of occurrences threatened / low degree and immediacy of threat or no current threats known)

Appendix C2. Potential for special-status wildlife species to occur in the Study Area. List compiled from the U.S. Fish and Wildlife Service (USFWS) Information for Conservation and Planning Database (USFWS 2018a) and the California Department of Fish and Wildlife (CDFW) Natural Diversity Database (CDFW 2018a) for the Dixon, Saxon, Clarksburg, Dozier, Liberty Island, Courtland, Bird's Landing, Rio Vista and Isleton USGS 7.5-minute quadrangles.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
Mammals			
American badger <i>Taxidea taxus</i>	SSC	Most abundant in drier open stages of most shrub, forest, and herbaceous habitats, with friable soils. Requires friable soils and open, uncultivated ground. Preys on burrowing rodents.	No Potential. The Study Area is a flood-irrigated farm, or duck hunting club, both practices would drown badgers and eliminates prey sources (e.g. ground squirrels). No sign of badgers have been observed during numerous field site visits by WRA.
California sea lion <i>Zalophus californianus</i>	MMPA (NMFS)	Range from central Mexico to British Columbia, Canada. Feeds on various fish and squid. Primary breeding range is from the Channel Islands in California to Southern Mexico.	Unlikely. While this species has been observed in sloughs surrounding the Study Area, no rookeries or haul outs are known in the vicinity, and the species is unlikely to utilize the habitat within the Study Area.
fringed myotis <i>Myotis thysanodes</i>	WBWG	Associated with a wide variety of habitats including dry woodlands, desert scrub, mesic coniferous forest, grassland, and sage-grass steppes. Buildings, mines and large trees and snags are important day and night roosts.	Unlikely. The Study Area does not contain the typical dry or xeric habitats used by this species. The cold, humid and windy nature of the Study Area makes thermoregulation by this species difficult and therefore unlikely to occur.
harbor seal <i>Phoca vitulina</i>	MMPA (NMFS)	Broadly distributed in coastal areas of the northern hemisphere. Most significant haul-out site in south San Francisco Bay is at Mowry Slough. Pups are born in March and April in Northern California.	Unlikely. This species is commonly known to travel through sections of the Sacramento and San Joaquin Rivers especially during salmon migrations. However, no suitable haul outs or rookery locations are present and the species is unlikely to utilize the habitat within the Study Area.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
hoary bat <i>Lasiurus cinereus</i>	WBWG	Prefers open habitats or habitat mosaics, with access to protected trees for cover and open areas or habitat edges for feeding. Roosts on the trunk of or within dense foliage of large trees. Feeds primarily on moths. Requires water in close proximity.	Unlikely. This species roosts entirely in trees. Tree roosting bats require very large diameter trees (diameter > 30 inches dbh) which are also protected from winds, can moderate humidity and provide stable thermoregulation (Silvis et al 2015). Any trees within the Study Area are typically unprotected and are exposed to cold, high velocity Delta winds making thermal stability unlikely to support tree roosting species.
long-eared myotis <i>Myotis evotis</i>	WBWG	Occurs in semiarid shrublands, sage, chaparral, and agricultural areas, but is usually associated with coniferous forests from seal level to 9000 feet. Individuals roost under exfoliating tree bark, and in hollow trees, caves, mines, cliff crevices, and rocky outcrops on the ground. They also sometimes roost in buildings and under bridges.	Unlikely. The Study Area does not contain the arid shrubland, or coniferous forest habitat typically associated with this species.
long-legged myotis <i>Myotis volans</i>	WBWG	Primarily found in dry coniferous forests, but also occurs seasonally in desert habitats. Large hollow trees, rock crevices and buildings are important day roosts. Other roosts include caves, mines and buildings.	Unlikely. The Study Area does not contain the coniferous forest this species typically inhabits. No rock outcroppings or mines occur within the Study Area. The Study Area is not in a dry or arid habitat as is typically used by this species.
pallid bat <i>Antrozous pallidus</i>	SSC, WBWG	Occupies a variety of habitats at low elevation including grassland, shrubland, woodland, and forest. Most common in open, dry habitats and commonly roosts in fissures in cliffs, abandoned buildings, and under bridges	Moderate Potential. Large trees or remnant farm buildings within the Study Area may provide suitable roosting habitat for this species, protecting it from thermal instability, and high winds. Close proximity to water and potential sources of forage are also nearby.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
salt-marsh harvest mouse <i>Reithrodontomys raviventris</i>	FE, SE, CFP, SSC	Found only in the saline emergent wetlands of San Francisco Bay and its tributaries. Pickleweed is primary habitat, but may use other thick wetland vegetation. Does not burrow, builds loosely organized nests. Requires higher areas for flood escape.	No Potential. The Study Area does not contain any salt marsh habitat that is required by this species. Furthermore, the species is not known for this portion of the northern Delta.
silver-haired bat <i>Lasionycteris noctivagans</i>	WBWG Medium	Primarily a forest dweller, feeding over streams, ponds, and open brushy areas. Summer habitats include a variety of forest and woodland types, both coastal and montane. Roosts in hollow trees, snags, buildings, rock crevices, caves, and under bark.	Unlikely. The Study Area does not contain the woodland or forest habitat typically associated with this species.
Suisun shrew <i>Sorex ornatus sinuosus</i>	SSC	Tidal marshes of the northern shores of San Pablo and Suisun Bays. Require dense low-lying cover and driftweed and other litter above the mean high tide line for nesting and foraging.	No Potential. This subspecies only occurs along the north and western shores of San Pablo Bay and does not occur further north in Solano County. The Study Area is outside of this subspecies' known range (Bolster 1998, CDFW 2018a).
Townsend's big-eared bat <i>Corynorhinus townsendii</i>	SSC, WBWG	Primarily found in rural settings in a wide variety of habitats including oak woodland and mixed coniferous-deciduous forest. Day roosts highly associated with caves and mines. Building roost sites must be cave like. Very sensitive to human disturbance.	Unlikely. This species typically requires undisturbed abandoned buildings, caves, or mines to support roosting. The few buildings on site are primarily open barns or occupied dwellings, which provide insufficient thermal regulatory properties for this species, or are too regularly disturbed to support roosting by this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
western red bat <i>Lasiurus blossevillii</i>	SSC, WBWG	This species is highly migratory and is typically solitary, roosting primarily in the foliage of trees or shrubs. It is associated with broad-leaved tree species including cottonwoods, sycamores, alders, and maples. Day roosts are commonly in edge habitats adjacent to streams or open fields, in orchards, and sometimes in urban areas.	Unlikely. This species roosts entirely in trees. Tree roosting bats require very large diameter trees (diameter > 30 inches dbh) which are also protected from winds, can moderate humidity and provide stable thermoregulation (Silvilis et al 2015). Any trees within the Study Area are typically unprotected and are exposed to cold, high velocity Delta winds making thermal stability unlikely to support tree roosting species.
Birds			
Allen's hummingbird <i>Selasphorus sasin</i>	BCC	Summer resident along the California coast, breeding in a variety of woodland and forest habitats, including parks and gardens with abundant nectar sources. Nest in shrubs and trees with dense vegetation.	Unlikely [to nest]. The Study Area does not contain typical coastal scrub, forest or woodland habitat used by this species for nesting. This species is not known to nest in this area of Solano County (Rippey et al 2014).
American peregrine falcon <i>Falco peregrinus anatum</i>	FD, SD, CFP, BCC	Year-round resident and winter visitor. Occurs in a wide variety of habitats, though often associated with coasts, bays, marshes and other bodies of water. Nests on protected cliffs and also on man-made structures including buildings and bridges. Preys on birds, especially waterbirds. Forages widely.	Unlikely [to nest]. The Study Area does not contain suitable tall cliffs or other such structures to support nesting by this species. The species may opportunistically forage or flyover the Study Area; however, suitable nesting habitat is lacking and the species is unlikely to breed in the Study Area.
American white pelican <i>Pelecanus erythrorhynchos</i>	SSC	Non-breeding visitor in most of California. Nests colonially on large interior lakes or rivers; breeding restricted to portions of eastern California. Winters on sheltered inland and estuarine waters with abundant small fishes for forage.	Unlikely [to nest]. While this species has been observed in the area, it is a winter visitor and does not breed in this section of California. Furthermore, the Study Area provides suboptimal foraging habitat, and while it may be observed flying over the Study Area, is more likely to utilize the adjacent tidal areas outside of the Study Area for foraging and loafing.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
bald eagle <i>Haliaeetus leucocephalus</i>	FD, SE, CFP, BCC, EPA	Occurs year-round in California, but primarily a winter visitor. Nests in large trees in the vicinity of larger lakes, reservoirs and rivers. Wintering habitat somewhat more variable but usually features large concentrations of waterfowl or fish.	Unlikely [to nest]. This species is not known to nest within this portion of Solano County (Rippey et al 2014). While the species may infrequently be observed flying over the Study Area, the Study Area provides suboptimal nesting and foraging habitat and is unlikely to support the species.
black oystercatcher <i>Haematopus bachmani</i>	BCC	Resident on rocky shores of marine habitats along almost the entire California coast and adjacent islands. Breeds on undisturbed, rocky, open shores and cliffs.	No Potential [to nest]. The Study Area does not contain rocky marine shorelines used by this species.
black-crowned night heron <i>Nycticorax nycticorax</i>	none (nesting sites protected by CDFW)	Primarily a year-round resident. Colonial nester, usually in trees, occasionally in tule patches. Rookery sites located adjacent to foraging areas: lake margins, mud-bordered bays, marshy spots. Largely nocturnal, roosting during the day.	Moderate Potential [to nest]. A rookery of egrets and cormorants is located outside of the Study Area on a series of small islands within Hass Slough. This species has also been observed foraging and perching during surveys. A potential roosting or rookery was observed within the northern riparian portion of Lookout Slough.
Bryant's savannah sparrow <i>Passerculus sandwichensis alaudinus</i>	SSC	Year-round resident associated with the coastal fog belt, primarily between Humboldt and northern Monterey Counties. Occupies low tidally influenced habitats and adjacent areas; often found where wetland communities merge into grassland. May also occur in drier grasslands. Nests near the ground in taller vegetation, including along roads, levees, and canals.	Unlikely [to nest]. Short stature grasslands such as those found within the Study Area are typically nesting habitat for this species. However, the Study Area is outside of the known range of the coastal Bryant's savannah sparrow (Shuford and Gardali 2008).

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
burrowing owl <i>Athene cunicularia</i>	BCC, SSC	Year-round resident and winter visitor. Occurs in open, dry grasslands and scrub habitats with low-growing vegetation, perches and abundant mammal burrows. Preys upon insects and small vertebrates. Nests and roosts in old mammal burrows, most commonly those of ground squirrels.	Unlikely [to nest]. Burrowing owls require small mammal burrows (i.e. ground squirrel), or burrow surrogates in order to nest. The Study Area uses flood irrigation for both ranching and hunting areas. The use of flood irrigation drowns squirrels and collapses their burrows. Small mammals are also considered a threat to levee integrity and are managed to prevent levee failures (Van Vuren et al. 2014). No ground squirrel colonies were observed within the Study Area and no former ground squirrel burrows were observed during the site visits. No suitable burrow surrogates were observed that might sustain owl nesting. The absence of ground squirrels or other burrow surrogates makes the Study Area unlikely to support nesting owls.
California black rail <i>Laterallus jamaicensis coturniculus</i>	ST, CFP	Year-round resident in marshes (saline to freshwater) with dense vegetation within four inches of the ground. Prefers larger, undisturbed marshes that have an extensive upper zone and are close to a major water source. Extremely secretive and cryptic.	Unlikely [to nest]. As part of the surveys performed in 2018, surveys for this species in the marshes around Liberty Island were conducted. No rails of any species were detected during the surveys, which included passive listening, and active playback. Despite the presence of marshes around the southern edge of the Study Area, no detections were made and the species is unlikely to be present.
California least tern <i>Sternula (formerly Sterna) antillarum browni</i>	FE, SE, CFP	Summer resident, nesting colonially in coastal and estuarine areas from San Francisco Bay south. Breeding colonies in the San Francisco Bay Estuary found on protected estuarine shores and salt ponds. Prefers barren or sparsely vegetated, flat substrates near water. Forages for small surface fish along shores, coasts, etc.	Unlikely [to nest]. The Study Area does not contain any salt ponds, alkaline lakes, salt flats, gravel bars or other such features, which are required to support nesting by the species. The species may infrequently be observed flying over the Study Area, or potentially opportunistically foraging in the adjacent sloughs, but the Study Area provides no nesting and suboptimal foraging for the species. Therefore, it is unlikely to occur.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
Clark's grebe <i>Aechmophorus clarkii</i>	BCC	(Nesting) Primarily breeds in northeastern California near Lassen, Siskiyou, Lake and Butte Counties in close association with large lakes.	No Potential [to nest]. No suitable lakes or other such large waterbodies are present for this species to nest. The species may be seen in the vicinity during winter migrations and may also forage in waters of the Study Area. There is no potential for the species to utilize the Study Area for nesting.
double-crested cormorant <i>Phalacrocorax auritus</i> not SSC or BCC	DFW:WL	(Rookery site) colonial nester on coastal cliffs, offshore islands, and along lake margins in the interior of the state. Nests along coast on sequestered islets, usually on ground with sloping surface, or in tall trees along lake margins.	Unlikely [to nest]. A rookery of egrets and cormorants is located outside of the Study Area on a series of small islands within Hass Slough. No nesting activity or rookeries for cormorants have been found within the Study Area. Because optimal nesting habitat is found outside of the Study Area, and no nests have thus far been observed within the Study Area, it is unlikely the species would begin nesting within the Study Area, especially due to the ongoing disturbances associated with ranching and hunting.
golden eagle <i>Aquila chrysaetos</i>	BCC, CFP, EPA	Occurs year-round in rolling foothills, mountain areas, sage-juniper flats, and deserts. Cliff-walled canyons provide nesting habitat in most parts of range; also nests in large trees, usually within otherwise open areas.	Unlikely [to nest]. The Study Area does not contain cliffs or large snags typically used for nesting by this species. This species typically prefers to forage in hills or grasslands with large populations of prey items (e.g. ground squirrels). No large populations of prey are present due to the flood irrigation practices used throughout the Study Area. The absence of both nesting structures and prey sources make it highly unlikely to species would occur within the Study Area.
grasshopper sparrow <i>Ammodramus savannarum</i>	SSC	Summer resident in the region. Breeds in open grassland habitats, generally with low- to moderate-height grasses and scattered shrubs.	Moderate Potential [to nest]. Though subject to flooding by agriculture, short stature grasslands maintained by grazing and ranching are likely to provide suitable nesting habitat for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
great blue heron <i>Ardea herodias</i>	none (nesting sites protected by CDFW)	Primarily a year-round resident. Colonial nester in tall trees, cliffs, and sequestered spots on marshes. Rookery sites in close proximity to foraging areas: marshes, lake margins, tide-flats, rivers and streams, wet meadows.	Unlikely [to nest]. A rookery of egrets, black-crowned night herons, and cormorants is located outside of the Study Area on a series of small islands within Hass Slough. No nesting activity or rookeries for this or other such species have been found within the Study Area. Because optimal nesting habitat is found outside of the Study Area, and no nests have thus far been observed within the Study Area, it is unlikely the species would begin nesting within the Study Area, especially due to the ongoing disturbances associated with ranching and hunting.
great egret <i>Ardea alba</i>	none (nesting sites protected by CDFW)	Primarily a year-round resident. Colonial nester in large trees. Rookery sites located near marshes, tide-flats, irrigated pastures, and margins of rivers and lakes.	Unlikely [to nest]. A rookery of egrets and cormorants is located outside of the Study Area on a series of small islands within Hass Slough. No nesting activity or rookeries for this or other egrets have been found within the Study Area. Because optimal nesting habitat is found outside of the Study Area, and no nests have thus far been observed within the Study Area, it is unlikely the species would begin nesting within the Study Area, especially due to the ongoing disturbances associated with ranching and hunting.
greater sandhill crane <i>Grus canadensis tabida</i>	ST, CFP	Utilizes wetlands, nesting in wet meadows, often in dense emergent vegetation to avoid nest predation. After fledging, cranes forage in irrigated grain fields near high quality roosting areas. Winter in the Central Valley.	Moderate Potential [to forage in winter]. Though the Study Area provides winter foraging when the species seasonally migrates to the region, this species has not been documented on site and is rarely observed in this portion of the Delta (Sullivan et al 2018). Greater sandhill crane do not nest/breed in the Delta or the Central Valley. If present, the species would likely be found foraging in the agricultural fields.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
Lawrence's goldfinch <i>Spinus (= Carduelis) lawrencei</i>	BCC	Nests in open oak or other arid woodland and chaparral, near water. Nearby herbaceous habitats used for feeding. Closely associated with oaks.	Unlikely [to nest]. The Study Area does not contain oak woodland or chaparral habitat associated with this species, and this species is not known to nest in the Delta marshlands of Solano County (Rippey et al 2014).
least bell's vireo <i>Vireo bellii pusillus</i>	FE, SE	Summer resident. Breeds in riparian habitat along perennial or intermittent rivers and creeks; prefers a multi-tiered canopy with dense early successional vegetation in the understory. Willows, mulefat and other understory species are typically used for nesting.	Unlikely [to nest]. The Study Area is within the historic range of the species; however, there are no extant occurrences of breeding pairs within Solano or Yolo County. The closest documented extant occurrence is from 2009 in Stanislaus County, along the San Joaquin River, approximately 53 miles to the southeast (CNDDDB 2019). Habitat within the Study Area is marginal and largely absent of dense multi-tiered riparian, and limited to the riparian habitat along Lookout Slough. Accounts of individuals, believed to be singing males, have been reported for Solano and Yolo County; however, no nesting or breeding has been documented (Howell et al. 2010, eBird 2019).
least bittern <i>Ixobrychus exilis</i>	SSC, BCC	Summer resident in portions of the Central Valley and southern California. Typically breeds in deeper freshwater marshes with dense emergent and woody vegetation.	Moderate Potential [to nest]. Marshes around the southern end of the Study Area (Liberty Farms) may provide suitable nesting and foraging habitat for this species.
lesser sandhill crane <i>Grus canadensis canadensis</i>	SSC	(Wintering) Breeds in southern Alaska and winters in the Central and Imperial Valleys of California. Winters in plains and valleys near fresh, shallow water; typically grain fields and irrigated pastures.	Moderate Potential [to forage in winter]. Though the Study Area provides potential winter foraging when the species seasonally migrates to the region, this species has not been documented on site and is rarely observed in this portion of the Delta (Sullivan et al 2018). Lesser sandhill crane do not nest/breed in the Delta or the Central Valley. If present, the species would likely be found foraging in the agricultural fields.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
Lewis's woodpecker <i>Melanerpes lewis</i>	BCC	Uncommon resident in California occurring on open oak savannahs, broken deciduous and coniferous habitats. Breeds primarily in ponderosa pine forests, riparian woodlands and disturbed pine forests but is also known to nest in orchards and oak woodlands. Rare nester in the San Francisco Bay Area.	Unlikely [to nest]. The Study Area and surroundings do not contain the woodland or savannah habitats required to support this species. Additionally, this species is uncommon in the region and is only known as a migrant or winter visitor (Glover 2009).
loggerhead shrike <i>Lanius ludovicianus</i>	BCC, SSC	Found in broken woodlands, savannah, pinyon-juniper, Joshua tree and riparian woodlands, and desert oases, scrub, and washes. Prefers open country for hunting, with perches for scanning, and fairly dense shrubs and brush for nesting.	Present. This species uses riparian woodlands like those along the periphery of the Study Area to nest. Short, unobstructed grasslands also provide suitable foraging habitat for the species. This species was observed during the January 2018 site assessment.
long-billed curlew <i>Numenius americanus</i>	BCC	(Nesting) breeds in upland shortgrass prairies and wet meadows in northeastern California. Habitats on gravelly soils and gently rolling terrain are favored over others	No Potential [to nest]. This species does not nest in this portion of California (USFWS 2018a). The species can be found foraging in the area during winter migrations only, as there is no potential for the species to utilize the Study Area for nesting.
marbled godwit <i>Limosa fedoa</i>	BCC	(Nesting) Breed in shortgrass prairies near wetlands outside of California. On the wintering grounds, Marbled Godwits forage and rest along coastal mudflats, estuaries, and sandy beaches.	No Potential [to nest]. This species does not nest in this portion of California (USFWS 2018a). The species can be found foraging in the area during winter migrations only, as there is no potential for the species to utilize the Study Area for nesting.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
mountain plover <i>Charadrius montanus</i>	BCC, SSC	Winter visitor to the Central Valley and some interior portions of southern California. Wintering habitats consist of areas with very short vegetation and/or bare ground, and flat topography; agricultural fields are used most frequently. Does not breed in California.	No Potential [to nest], Unlikely [to forage in winter]. This species does not nest in California. While the species may occasionally forage in the vicinity, the Study Area contains flood irrigated pasture or marsh, both of which have unsuitable hydrologic conditions and vegetative composition to support preferred foraging habitat for this species. It is unlikely to winter within the Study Area.
northern harrier <i>Circus cyaneus</i>	SSC	Nests and forages in grassland habitats, usually in association with coastal salt and freshwater marshes. Nests on ground in shrubby vegetation, usually at marsh edge; nest built of a large mound of sticks in wet areas. May also occur in alkali desert sinks.	High Potential [to nest]. The species has been observed in the area during wildlife surveys. Open areas with shrubby vegetation and the close proximity to marsh and foraging habitat create potential nesting habitat for the species. While agricultural disturbance may degrade portions of the nesting habitat, the large scale of the site and open non-wooded sections of the Study Area result in a high potential for the species to nest in the Study Area.
Nuttall's woodpecker <i>Picoides nuttallii</i>	BCC	Resident in lowland woodlands throughout much of California west of the Sierra Nevada. Typical habitat is dominated by oaks.	High Potential [to nest]. Large trees bearing woodpecker holes have been observed around the Study Area.
oak titmouse <i>Baeolophus inornatus</i>	BCC	Oak woodland and savannah, open broad-leaved evergreen forests containing oaks, and riparian woodlands. Associated with oak and pine-oak woodland and arborescent chaparral.	Unlikely [to nest]. This species is not known to nest within this portion of Solano County (Rippey et al 2014). Additionally, this species generally requires expanses of savannah or oak woodlands to support nesting, neither of which are present.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
Ridgway's (clapper) rail <i>Rallus obsoletus obsoletus</i>	FE, SE, CFP	Year-round resident in tidal marshes of the San Francisco Bay estuary. Requires tidal sloughs and intertidal mud flats for foraging, and dense marsh vegetation for nesting and cover. Typical habitat features abundant growth of cordgrass and pickleweed. Feeds primarily on mollusks and crustaceans.	No Potential [to nest]. The Study Area is outside of the known range for this species. Additionally, no salt marsh is present to support the species.
San Francisco common yellowthroat <i>Geothlypis trichas sinuosa</i>	BCC, SSC	Resident of the San Francisco Bay region, in fresh and saltwater marshes. Range extends northward to Tomales Bay, east to the Carquinez Straight and south to San Jose. Requires thick, continuous cover down to water surface for foraging; tall grasses, tule patches, willows for nesting.	No Potential [to nest]. The eastern extent of this subspecies' range is at the Carquinez Straight. The Study Area is approximately 30 miles east of the Carquinez Straight, and therefore outside of the species known range.
short-billed dowitcher <i>Limnodromus griseus</i>	BCC	Breeds in muskegs of taiga to timberline, and barely onto subarctic tundra. Winters on coastal mud flats and brackish lagoons. Prefers saltwater tidal flats, beaches, salt marshes but may also be found in freshwater mud flats and flooded agricultural fields during migration.	No Potential [to nest]. This species does not nest in this portion of California (USFWS 2018a). The species can be found foraging in the area during winter migrations only. Because the species does not nest in the area, there is no potential to impact nesting by this species from the Project.
short-eared owl <i>Asio flammeus</i>	SSC	Primarily a winter visitor in the region, with very restricted local breeding. Occurs in open, treeless areas (e.g. marshes, grasslands) with elevated sites for foraging perches and dense vegetation for roosting and nesting. Preys on small mammals, most particularly voles.	Unlikely [to nest]. The Study Area does not contain suitable expanses of marsh to support foraging or nesting. Within the Study Area grazing operations keep grasslands throughout the area short which is preferable, but the Study Area also experiences a high level of disturbance due to ranching and hunting practices. This species is not known to nest in this area of Solano County (Rippey et al 2014)

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
snowy egret <i>Egretta thula</i>	none (nesting sites protected by CDFW)	Primarily a year-round resident. Colonial nester, with nest sites situated in trees or protected beds of emergent vegetation. Rookery sites situated close to foraging areas: marshes, tidal-flats, streams, wet meadows, and borders of lakes.	Unlikely [to nest]. A rookery of egrets and cormorants is located outside of the Study Area on a series of small islands within Hass Slough. No nesting activity or rookeries for this or other such species have been found within the Study Area. Because optimal nesting habitat is found outside of the Study Area, and no nests have thus far been observed within the Study Area, it is unlikely the species would begin nesting within the Study Area, especially due to the ongoing disturbances associated with ranching and hunting.
song sparrow – “Modesto Population” <i>Melospiza melodia</i>	SSC, BCC	Restricted to the Sacramento and extreme northern San Joaquin Valleys from Colusa County south to Stanislaus County. Associated with woody riparian habitat and freshwater marshes.	Present. This species has been documented within 5-miles of the Study Area (CDFW 2018a) and song sparrows observed on site fall within the range of the Modesto Population. When present, the species would most likely be found within the marsh and riparian habitats within the Study Area.
song sparrow – “Suisun Population” <i>Melospiza melodia maxillaris</i>	BCC, SSC	Resident of brackish-water marshes surrounding Suisun Bay. Inhabits cattails, tules and other sedges, and <i>Salicornia</i> ; also known to frequent tangles bordering sloughs.	No Potential [to nest]. The Study Area is located outside this subspecies’ range along Suisun Bay.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
Swainson's hawk <i>Buteo swainsoni</i>	ST, BCC	Summer resident in California's Central Valley and limited portions of the southern California interior. Nests in tree groves and isolated trees in riparian and agricultural areas, including near buildings. Forages in grasslands and scrub habitats as well as agricultural fields, especially alfalfa. Preys on arthropods year-round as well as smaller vertebrates during the breeding season.	Present. During surveys conducted in 2018 WRA biologists identified two nests for this species within the Study Area. Two additional nests were observed during the same surveys in close proximity to the Study Area, but outside of the actual property boundary.
tricolored blackbird <i>Agelaius tricolor</i>	ST, BCC, SSC	Usually nests over or near freshwater in dense cattails, tules, or thickets of willow, blackberry, wild rose or other tall herbs. Nesting area must be large enough to support about 50 pairs.	Moderate Potential [to nest]. There are records of the species within 5 miles of the Study Area, and likely breeding colonies within 10 miles (CDFW 2018a). Though the majority of the Study Area does not provide suitable habitat for the species, freshwater marshes with dense emergent vegetation on the margins of the Study Area, especially in the south, could potentially support habitat for a breeding colony. Current maintenance of much of the Liberty Farms area as managed wetlands could limit food availability during the nesting season, thus the restoration project would increase the chances that a colony would be found in the Study Area.
western snowy plover <i>Charadrius alexandrinus nivosus</i>	FT, BCC, SSC	Federal listing applies only to the Pacific coastal population. Year-round resident and winter visitor on sandy beaches, salt pond levees and shores of large alkali lakes. Requires sandy, gravelly or friable soils for nesting.	No Potential [to nest]. The Study Area does not contain sandy beaches, alkaline lakes or other such suitable habitat to support nesting by this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
western yellow-billed cuckoo <i>Coccyzus americanus</i>	FT, SE, BCC	Summer resident, breeding in dense riparian forests and jungles, typically with early successional vegetation present. Utilizes densely-foliaged deciduous trees and shrubs. Eats mostly caterpillars. Current breeding distribution within California very restricted.	No Potential [to nest]. The Study Area does not contain the dense old-growth riparian forest required by this species.
whimbrel <i>Numenius phaeopus</i>	BCC	Breeds in tundra habitat, from wet lowlands to dry heath. In migration, frequents various coastal and inland habitats, including fields and beaches. Winters in tidal flats and shorelines, occasionally visiting inland habitats.	No Potential [to nest]. This species does not nest in this portion of California (USFWS 2018a). The species can be found foraging in the area during winter migrations only. Because the species does not nest in the area, there is no potential to impact nesting by this species from the Project.
white-tailed kite <i>Elanus leucurus</i>	CFP	Year-round resident in coastal and valley lowlands with scattered trees and large shrubs, including grasslands, marshes and agricultural areas. Nests in trees, of which the type and setting are highly variable. Preys on small mammals and other vertebrates.	High Potential [to nest]. This species typically uses grassland or agricultural fields like those within the Study Area for foraging. Additionally, scattered large trees throughout the area may provide nesting habitat for the species. No active nests for this species were observed during surveys by WRA.
willet <i>Tringa semipalmata</i>	BCC	Inhabits open beaches, bayshores, marshes, mudflats, and rocky coastal zones. Nests inland on the ground along pond edges and other seasonal wetlands, or on raised sites near water, often in native grasslands.	No Potential [to nest]. This species does not nest in this portion of California (USFWS 2018a). The species can be found foraging in the area during winter migrations only. Because the species does not nest in the area, there is no potential to impact nesting by this species from the Project.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
wren <i>Chamaea fasciata</i>	BCC	Year-round resident in coastal scrub and chaparral along the West Coast. Nests in many types of vegetation including California sage, coyote brush, blackberry, poison oak, coffeeberry, Douglas-fir, bush lupine, wild rose, valley oak, and wild grape.	Unlikely [to nest]. The Study Area does not contain scrub or chaparral which is more characteristic of the species habitat. The Study Area provides suboptimal habitat for the species, and while it may infrequently be observed in the area, it is unlikely to nest in the Study Area.
yellow warbler <i>Setophaga (Dendroica) petechia brewsteri</i>	BCC, SSC	Frequents riparian plant associations. Prefers willows, cottonwoods, aspens, sycamores and alders for nesting and foraging. Also nests in montane shrubbery in open conifer forests.	Moderate Potential [to nest]. Willow riparian areas lining Lookout Slough and within portions of Liberty Farms provide potential nesting habitat for the species. Potential foraging habitat is also supported throughout the riparian and edge habitat as well.
yellow-billed magpie <i>Pica nuttalli</i>	BCC	Endemic to the Central Valley and central Coast Ranges. Favors open park-like areas with expanses of open ground, including oak savannah, orchards, and along stream courses. Large, dome-shaped stick nests are placed in trees.	Unlikely [to nest]. This species is not known to nest in this area of Solano County (Rippey et al 2014). Additionally, suitable nest trees are fairly uncommon except along waterways which are not typically favored nesting situations for the species. While the species has been observed on site, and may opportunistically forage in the Study Area, it is unlikely to nest at the site due to the absence of woodland habitat typical of the species nesting habitat requirements.
yellow-breasted chat <i>Icteria virens</i>	SSC	Summer resident, occurring in riparian areas with an open canopy, very dense understory, and trees for song perches. Nests in thickets of willow, blackberry, and wild grape.	Unlikely [to nest]. The Study Area does not contain dense riparian habitat to support foraging or nesting in this species. Additionally, this species is uncommon in the region and has very few documented nesting occurrences in Solano County (Rippey et al 2014; eBird 2017).

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
yellow-headed blackbird <i>Xanthocephalus xanthocephalus</i>	SSC	Summer resident. Breeds colonially in freshwater emergent wetlands with dense vegetation and deep water, often along borders of lakes or ponds. Requires abundant large insects such as dragonflies; nesting is timed for maximum emergence of insect prey.	Unlikely [to nest]. This species is not known to nest within this portion of Solano County (Rippey et al 2014). Individuals may winter with mixed flocks of blackbirds in the area; however, no nesting colonies have been documented within Solano or Yolo County (CDFW 2019). The Study Area is lacking suitable dense emergent wetlands bordering deep water characteristic of the species nesting habitat.
Reptiles and Amphibians			
California red-legged frog <i>Rana draytonii</i>	FT, SSC	Lowlands and foothills in or near permanent sources of deep water with dense, shrubby or emergent riparian vegetation. Requires 11 to 20 weeks of permanent water for larval development. Must have access to estivation habitat.	Unlikely. This species was evaluated as part of the Solano County HCP and the Study Area was determined to be outside of the species known range within Solano County (Solano 2012). The species was not observed during field surveys either, and it is unlikely to occur in the Study Area.
California tiger salamander <i>Ambystoma californiense</i>	FE/FT, ST, SSC	Inhabits grasslands, oak woodland and scrublands. Spends most of the year underground in mammal burrows and Adults utilize mammal burrows as estivation habitat.	Unlikely. The Study Area does not fall within the potential or known range of the species within Solano County (Solano 2012). The Study Area has been farmed as flood irrigated agriculture, a practice which is destructive to salamander habitat (Ford et al 2013). Additionally, the Study Area lies within the 100-year floodplain, an area which does not typically support the species due to loss of estivation habitat (FEMA 2017, Ford et al 2013).

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
giant garter snake <i>Thamnophis gigas</i>	FT, ST, RP	Prefers freshwater marsh and low gradient streams. Has adapted to drainage canals and irrigation ditches. This is the most aquatic of the garter snakes in California.	Present. During reconnaissance level eDNA surveys in 2018 this species was detected in Lookout and Sycamore Sloughs. Additionally, a specimen of this species was recorded in the CNDDDB on the roadway atop the boundary levee at the southeastern edge of the Study Area (CDFW 2018a).
western pond turtle <i>Actinemys marmorata</i>	SSC	Occurs in perennial ponds, lakes, rivers and streams with suitable basking habitat (mud banks, mats of floating vegetation, partially submerged logs) and submerged shelter.	Present. Within the slough complex surrounding the Study Area deep water habitat, foraging opportunities and basking sites such as downed trees and rocks are present and may support use by the species. Grassland habitat on the existing levees and within the Study Area provide potential nesting habitat.
Fish			
Chinook salmon, Central Valley fall/late fall-run Evolutionary Significant Unit (ESU) <i>Oncorhynchus tshawytscha</i>	SSC, NMFS	Populations spawning in the Sacramento and San Joaquin Rivers and their tributaries. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles may remain in fresh water for 1 or more years before migrating downstream to the ocean	High Potential. Cache, Hass and Shag Sloughs surround the Study Area and are used by juveniles of this species as rearing habitat. Typical spawning grounds for this species are upstream of the Study Area; therefore, it is likely that they will pass through and forage in sloughs surrounding the Study Area during outmigrations. The existing levee structure and water diversion system with the Study Area; however, excludes this species from occurring within the interior aquatic features of the site.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
Chinook salmon, Central Valley spring-run ESU <i>Oncorhynchus tshawytscha</i>	FT, ST, NMFS	Anadromous, spending most of life cycle in the ocean. Federal listing includes populations spawning in the Sacramento River and its tributaries. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for one or more years before migrating downstream to the ocean.	High Potential. Cache, Hass and Shag Sloughs surround the Study Area and are used by juveniles of this species as rearing habitat. Typical spawning grounds for this species are upstream of the Study Area; therefore, it is likely that they will pass through and forage in sloughs surrounding the Study Area during outmigrations.
Chinook salmon, Sacramento River winter-run ESU <i>Oncorhynchus tshawytscha</i>	FE, SE, NMFS	Occurs in the Sacramento River below Keswick Dam. Spawns in the Sacramento River but not in tributary streams. Requires clean, cold water over gravel beds with water temperatures between 6 and 14 degrees C for spawning. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles typically migrate to the ocean soon after emergence from the gravel.	High Potential. Cache, Hass and Shag Sloughs surround the Study Area and are used by juveniles of this species as rearing habitat. Typical spawning grounds for this species are upstream of the Study Area; therefore, it is likely that they will pass through and forage in sloughs surrounding the Study Area during outmigrations. The existing levee structure and water diversion system with the Study Area; however, excludes this species from occurring within the interior aquatic features of the site.
coho salmon, central California coast ESU <i>Oncorhynchus kisutch</i>	FE, SE, NMFS	Federal listing includes populations between Punta Gorda and San Lorenzo River. State listing includes populations south of San Francisco Bay only. Occurs inland and in coastal marine waters. Requires beds of loose, silt-free, coarse gravel for spawning. Also needs cover, cool water and sufficient dissolved oxygen.	No Potential. This species has been extirpated from the waters of San Francisco Bay and its tributaries.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
Delta smelt <i>Hypomesus transpacificus</i>	FT, SE	Endemic to the Sacramento Delta, where it is distributed from the Suisun Bay upstream through the Delta in Contra Costa, Sacramento, San Joaquin, Solano and Yolo counties. The delta smelt is a pelagic and euryhaline species	High Potential. Cache, Hass and Shag Sloughs that surround the Study Area are typical habitat used by adults and juveniles of this species. Nearby occurrences in CDFW trawls have confirmed the species is present in the Cache Slough Complex (CDFW 2017b). The existing levee structure and water diversion system with the Study Area; however, excludes this species from occurring within the interior aquatic features of the site.
green sturgeon, southern Distinct Population Segment (DPS) <i>Acipenser medirostris</i>	FT, SSC NMFS	Spawn in the Sacramento River and the Klamath River. Spawn at temperatures between 8-14 degrees C. Preferred spawning substrate is large cobble, but can range from clean sand to bedrock. Spawn in deep pools or "holes" in large, turbulent, freshwater river mainstems. Adults live in oceanic waters, bays, and estuaries when not spawning. Species is known to forage in estuaries and bays.	High Potential. Cache, Hass and Shag Sloughs surround the Study Area and are used by juveniles of this species as rearing habitat. Typical spawning grounds for this species are upstream of the Study Area within the Feather and Sacramento Rivers, therefore it is likely that the species will pass through or forage in sloughs surrounding the Study Area during outmigrations. The existing levee structure and water diversion system with the Study Area; however, excludes this species from occurring within the interior aquatic features of the site.
hardhead <i>Mylopharodon conocephalus</i>	SSC	Low to mid-elevation streams in the Sacramento-San Joaquin drainage. Clear, deep pools with sand-gravel-boulder bottoms and slow water velocity. Typically found with Sacramento Pikeminnow and Sacramento Sucker.	Unlikely. This species forages, rears and spawns in creeks or rivers with deep clear pools, and gravelly bottoms. These conditions are not present within or surrounding the Study Area.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
longfin smelt <i>Spirinchus thaleichthys</i>	ST, FC	Euryhaline, nektonic and anadromous. Found in open waters of estuaries, mostly in middle or bottom of water column. Prefer salinities of 15 to 30 ppt, but can be found in completely freshwater to almost pure seawater.	High Potential. Cache, Hass and Shag Sloughs that surround the Study Area are typical habitat used by adults and juveniles of this species. Nearby occurrences in CDFW trawls have confirmed the species is present in the Cache Slough Complex (CDFW 2017b). The existing levee structure and water diversion system with the Study Area; however, excludes this species from occurring within the interior aquatic features of the site.
Sacramento Splittail <i>Pogonichthys macrolepidotus</i>	SSC	Endemic to the lakes and rivers of the Central Valley, but now confined to the Sacramento Delta, Suisun Bay and associated marshes. Occurs in slow-moving river sections and dead end sloughs. Requires flooded vegetation for spawning and foraging for young. Splittail are primarily freshwater fish, but are tolerant of moderate salinity and can live in water where salinity levels reach of 10-18 parts per thousand.	Present. During fisheries surveys in 2018 this species was observed within the irrigation ditches running throughout the Study Area. Nearby occurrences in CDFW trawls have also confirmed the species is present in the Cache Slough Complex (CDFW 2018b).
steelhead - Central Valley DPS <i>Oncorhynchus mykiss</i>	FT, NMFS	Anadromous, spending most of life cycle in the ocean. Occurs in the Sacramento and San Joaquin Rivers and their tributaries, excluding San Francisco and San Pablo bays and their tributaries. Adults migrate upstream to spawn in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for 1 or more years before migrating downstream to the ocean.	High Potential. Cache, Hass and Shag Sloughs surround the Study Area and are used by juveniles of this species as rearing habitat. Typical spawning grounds for this species are also upstream of the Study Area; therefore, it is likely that they will pass through and forage in sloughs surrounding the Study Area during outmigrations. The existing levee structure and water diversion system with the Study Area; however, excludes this species from occurring within the interior aquatic features of the site.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
tidewater goby <i>Eucyclogobius newberryi</i>	FE, SSC	Habitat is characterized by brackish water in shallow lagoons and in lower stream reaches where the water is fairly still but not stagnant. Restricted to waters with low to moderate salinities in California's coastal wetland habitats.	No Potential. This species has been extirpated from the waters of San Francisco Bay and its tributaries.
white sturgeon <i>Acipenser transmontanus</i>	SSC	Found in most estuaries along the Pacific coast. Adults in the San Francisco Bay Estuary system spawn in the Sacramento River and are not known to enter freshwater or non-tidal reaches of Estuary streams. Spawn May through June.	Moderate Potential. Cache, Hass and Shag Sloughs surround the Study Area and are used by juveniles of this species as rearing habitat. Typical spawning grounds for this species are upstream of the Study Area within the Sacramento and Feather Rivers, therefore it is likely that they will migrate through waters surrounding the Study Area during outmigrations. The existing levee structure and water diversion system with the Study Area; however, excludes this species from occurring within the interior aquatic features of the site.
Invertebrates			
Antioch Dunes anthicid beetle <i>Anthicus antiochensis</i>	SSI	<i>Anthicus antiochensis</i> is apparently extirpated from the type locality at Antioch Dunes. Stabilization of the dunes in the 1950s may have eliminated the loose, sandy substrate preferred by this species. In the early 1990s it was collected for the first time at several sites along the Sacramento River in Glenn, Tehama, Shasta, and Solano Counties, and from one site at Nicolas on the Feather River in Sutter County (Davis 1991). bare, unvegetated sand	No Potential. The Study Area is outside of the known range for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
<p>California linderiella <i>Linderiella occidentalis</i></p>	<p>SSI</p>	<p>Seasonal pools in unplowed grasslands with old alluvial soils underlain by hardpan or in sandstone depressions. Water in the pools has very low alkalinity, conductivity, and TDS.</p>	<p>No Potential. While occurrences of this species are recorded within 5-miles of the Study Area, they are restricted to higher elevation uplands to the north and west (CDFW 2018a). Uplands in these areas support vernal pools, which are required by the species. The Study Area is outside of both the historic and current distribution of vernal pools within Solano County (Solano 2012). Additionally, lands within the Study Area have been used for flood irrigated pasture and winter waterfowl management collectively for several decades which are practices that eliminates use of an area as branchiopod habitat (USFWS 2007).</p>
<p>Callippe silverspot butterfly <i>Speyeria callippe callippe</i></p>	<p>FE, SSI</p>	<p>Two populations in San Bruno mountain and the Cordelia Hills are recognized. Hostplant is <i>Viola pedunculata</i>, which is found on serpentine soils. Most adults found on east-facing slopes; males congregate on hilltops in search of females.</p>	<p>No Potential. The Study Area is outside of the very restricted range of this species and does not contain suitable habitat nor the host plant.</p>

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
<p>conservancy fairy shrimp <i>Branchinecta conservatio</i></p>	<p>FE, SSI, RP</p>	<p>Endemic to the grasslands of the northern two-thirds of the Central Valley; found in large, turbid pools. Inhabit astatic pools located in swales formed by old, braided alluvium; filled by winter/spring rains, last until June.</p>	<p>No Potential. While occurrences of this species are recorded within 5-miles of the Study Area, they are restricted to higher elevation uplands to the north and west (CDFW 2018a). Uplands in these areas support vernal pools, which are required by the species. The Study Area is outside of both the historic and current distribution of vernal pools within Solano County (Solano 2012). Additionally, lands within the Study Area have been used for flood irrigated pasture and winter waterfowl management collectively for several decades which are practices that eliminates use of an area as branchiopod habitat (USFWS 2007).</p>
<p>Delta green ground beetle <i>Elaphrus viridis</i></p>	<p>FT, SSI, RP</p>	<p>Restricted to the margins of vernal pools in the grassland area between Jepson Prairie and Travis Air Force Base. Prefers the sandy mud substrate where it slopes gently into the water, with low-growing vegetation, 25 to 100% cover.</p>	<p>No Potential. The Project does not contain vernal pools suitable to support this species. Additionally grazing, farming, duck hunting and flood irrigation are practices which diminish conditions required to support this species.</p>

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
midvalley fairy shrimp <i>Branchinecta mesovallensis</i>	SSI	Known only from the Central Valley, primarily its central portions. Typically inhabits short-lived, grass-bottomed vernal pools and other seasonal water features.	No Potential. While occurrences of this species are recorded within 5-miles of the Study Area, they are restricted to higher elevation uplands to the north and west (CDFW 2018a). Uplands in these areas support vernal pools, which are required by the species. The Study Area is outside of both the historic and current distribution of vernal pools within Solano County (Solano 2012). Additionally, lands within the Study Area have been used for flood irrigated pasture and winter waterfowl management collectively for several decades which are practices that eliminates use of an area as branchiopod habitat (USFWS 2007).
Ricksecker's water scavenger beetle <i>Hydrochara rickseckeri</i>	SSI	Small aquatic beetle known only from pond habitats scattered around the San Francisco Bay area, including Marin, Sonoma, Alameda, and Contra Costa counties. Extensive surveys from 1988 failed to locate this species. The locations of existing populations remain unknown (Hafernick 1989).	No Potential. The Study Area is outside of the species known range.
Sacramento anthicid beetle <i>Anthicus sacramento</i>	SSI	Anthicus sacramento is found in several locations along the Sacramento and San Joaquin rivers, from Shasta to San Joaquin counties, and at one site along the Feather River at Nicolaus. Inhabit sand slipfaces among bamboo and willow. Interior sand dunes and sand bars; has also been found in dredge spoil heaps	No Potential. The Study Area is not within the limited range for this species.

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
valley elderberry longhorn beetle <i>Desmocerus californicus dimorphus</i>	FT, SSI, RP	Occurs only in the central valley of California, in association with blue elderberry (<i>Sambucus</i> spp.). Prefers to lay eggs in elderberry 2 to 8 inches in diameter; some preference shown for "stressed" elderberry.	<p>Unlikely. Lands within the Study Area have been used for flood irrigated pasture and winter waterfowl management collectively for several decades. Land management, grazing practices, and levee maintenance result in frequent disturbance and alteration of vegetation within the Study Area. In 2018, focus surveys for elderberry (the species host plant) were conducted and only one small isolated group of elderberry shrubs were found on the outboard (flood side) of the levee, in an area devoid of a dominant riparian canopy vegetation layer. Surveys followed USFWS 2017 <i>Framework for Assessing Impacts to the Valley Elderberry Longhorn Beetle</i>, which included all areas within 50 m (165 ft) of the host plant. No exit holes of any type were observed in the elderberry shrubs; which only occurred in an area subject to flooding and within an area where levee maintenance frequently occurs as evident by riprap near the plants. Due to the extensive disturbance, isolation of the Study Area from documented occurrences, marginal host plant availability, and absence of exit holes, it is unlikely that the species would occur in the Study Area.</p>

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
Vernal pool andrenid bee <i>Andrena blennospermatis</i>	SSI	A solitary, ground-nesting bee found in upland areas near vernal pools. Its host plant is <i>Blennosperma spp.</i> and does not forage far from the host plant. Range is Contra Costa, El Dorado, Lake, Placer, Sacramento, San Joaquin, Solano, Sonoma, Tehama, and Yolo counties.	No Potential. While occurrences of this species are recorded within 5-miles of the Study Area, they are restricted to higher elevation uplands to the north and west (CDFW 2018a). Uplands in these areas support vernal pools, which are required by the species. The Study Area is outside of both the historic and current distribution of vernal pools within Solano County (Solano 2012). Additionally, lands within the Study Area have been used for flood irrigated pasture and winter waterfowl management collectively for several decades which are practices that eliminates use of an area as branchiopod habitat (USFWS 2007).
vernal pool fairy shrimp <i>Branchinecta lynchi</i>	FT, SSI, RP	Endemic to the grasslands of the Central Valley, central coast mountains, and south coast mountains, in astatic rain-filled pools. Inhabit small, clear-water sandstone-depression pools and grassed swale, earth slump, or basalt-flow depression pools.	No Potential. While occurrences of this species are recorded within 5-miles of the Study Area, they are restricted to higher elevation uplands to the north and west (CDFW 2018a). Uplands in these areas support vernal pools, which are required by the species. The Study Area is outside of both the historic and current distribution of vernal pools within Solano County (Solano 2012). Additionally, lands within the Study Area have been used for flood-irrigated pasture and winter waterfowl management collectively for several decades which are practices that eliminates use of an area as branchiopod habitat (USFWS 2007).

SPECIES	STATUS*	HABITAT	POTENTIAL FOR OCCURRENCE
vernal pool tadpole shrimp <i>Lepidurus packardi</i>	FE, SSI, RP	Inhabits vernal pools and swales in the Sacramento Valley containing clear to highly turbid water. Pools commonly found in grass bottomed swales of unplowed grasslands. Some pools are mud-bottomed and highly turbid.	No Potential. While occurrences of this species are recorded within 5-miles of the Study Area, they are restricted to higher elevation uplands to the north and west (CDFW 2018a). Uplands in these areas support vernal pools, which are required by the species. The Study Area is outside of both the historic and current distribution of vernal pools within Solano County (Solano 2012). Additionally, lands within the Study Area have been used for flood-irrigated pasture and winter waterfowl management collectively for several decades which are practices that eliminates use of an area as branchiopod habitat (USFWS 2007).
western bumble bee <i>Bombus occidentalis</i>	SSI	Formerly common throughout much of western North America; populations from southern British Columbia to central California have nearly disappeared (Xerces 2017). Occurs in a wide variety of habitat types. Nests are constructed annually in pre-existing cavities, usually on the ground (e.g. mammal burrows). Many plant species are visited and pollinated.	Unlikely. Lands within the Study Area have been used for flood-irrigated pasture and winter waterfowl management collectively for several decades. Land management, grazing practices, and levee maintenance result in frequent disturbance and minimize available small mammal burrows. Therefore, the Study Area is unlikely to support nesting by the species.

*** Key to status codes:**

EPA	Eagle Protection Act Species
FE	Federal Endangered
FT	Federal Threatened
FD	Federal Delisted
FC	Federal Candidate
BCC	USFWS Birds of Conservation Concern
SE	State Endangered
ST	State Threatened
SD	State Delisted
SC	State Candidate

SSC	CDFW Species of Special Concern
SSI	CDFW Special-Status Invertebrate
CFP	CDFW Fully Protected Animal
WBWG	Western Bat Working Group (High or Medium) Priority species
NMFS	Managed by the National Marine Fisheries Service

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APPENDIX D
SITE PHOTOGRAPHS

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Photo 1. View facing northeast of tidal waters of Shag Slough along the eastern portion of the Study Area. Photograph taken from perimeter levee on August 27, 2018.



Photo 2. Developed land within the eastern portion of Liberty Farms. Photograph taken April 28, 2017 facing south from perimeter levee with tidal Shag Slough on left.



Photo 3. View of non-native grassland in northern portion of Liberty Farms, located centrally in the Study Area. Photograph taken April 5, 2015.



Photo 4. View facing north of coastal and valley freshwater marsh within Liberty Farms. Photograph taken August 27, 2018.



Photo 5. View facing west of terminus of non-tidal open waters of Lookout Slough with great valley mixed riparian on right. Photograph taken from perimeter levee in northeastern portion of the Study Area on April 5, 2018.



Photo 6. View facing east of non-tidal open waters of Lookout Slough with great valley mixed riparian in background. Photograph taken from perimeter levee in southwest portion of Study Area on July 28, 2017.



Photo 7. View facing northeast of tidal waters of Shag Slough along the eastern portion of the Study Area. Photograph taken from perimeter levee on August 27, 2018.



Photo 8. Non-tidal waters associated with Sycamore Slough in Bowsbey Ranch. Taken January 6, 2017 and facing north.



Photo 9. View facing south of tidal waters of Cache Slough within the southern portion of the Study Area, with the Vogel property on the right and Liberty Farms on the left. Photograph taken August 27, 2018.



Photo 10. View facing south of tidal waters of Haas Slough within western portion of Study Area. Photograph taken September 19, 2017.



Photo 11. View facing north of irrigated pasture within Bowsbey Ranch. Photograph taken August 27, 2018.



Photo 12. Developed (agricultural road), irrigated pasture, and open water (drainage ditch) biological communities on Bowsbey Ranch. Taken January 6, 2017 and facing west.



Photo 13. Non-native grassland biological community on Vogel Island. Taken January 6, 2017 and facing south.



Photo 14. Developed (perimeter levee road) and great valley mixed riparian biological communities on Vogel property. Taken January 6, 2017 and facing south.

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